RIODICAL Denmark. Dan. Fisk. Hav.
10, no.1 Medd. Serie: Fisk.
LIBRARY
FISH. & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS
10(1)

MEDDELELSER

FRA

KOMMISSIONEN FOR DANMARKS FISKERI- OG HAVUNDERSØGELSER

SERIE: FISKERI · BIND X

NR. 1. PAUL M. HANSEN, AD. S. JENSEN & Å. VEDEL TÅNING: COD MARKING EXPERIMENTS IN THE WATERS OF GREENLAND 1924—1933

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1935

MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER

Serie: Fiskeri.

Bind I.

Nr. 1 C. G. Joh. Petersen: On the larval and postlarval stages of the long Rough Dab and the Genus Pleuronectes. 2 Plates. 1904. 13 p. Kr. 1.00.

» 2 A. C. Johansen: Contributions to the biology of the Plaice with special regard to the Danish Plaice-Fishery. I. 12 Plates. 1905. 70 p. Kr. 5.25.

» 3 Johs. Schmidt: On pelagic post-larval Halibut. (Hippoglossus vulgaris Flem. and H. hippoglossoïdes Walb.) 1 Plate. 1904. 13. p. Kr. 0.75.

» 4 Johs. Schmidt: De atlantiske Torskearter (Gadus-Slægtens) pelagiske Yngel i de postlarvale Stadier. Med 3 Tavler og 16 Figurer. 1905. 74 S. Kr. 3.00.

» 4 Johs. Schmidt: The pelagic post-larval stages of the Atlantic Species of Gadus. A Monograph with 3 Plates and 16 Figures in the Text. 1905. 77 p. Kr. 3.00.

» 5 C. G. Joh. Petersen: Larval Eels (Leptocephalus brevirostris) of the Atlantic coasts of Europe. 1905. 5 p.

» 6 A. C. Johansen: Remarks on the life history of the young post-larval Eel (Anguilla vulgaris Turt.) 1904. 9 p. Kr. 0.50.

» 7 Adolf Sev. Jensen: On fish-otoliths in the bottom-deposits of the Sea. I. Otoliths of the Gadus-Species deposited in the Polar Deep. 4 Fig. 1905. 14 p. Kr. 0.50.

» 8 Johs. Schmidt: On the larval and post-larval stages of the Torsk (Brosmius brosme [Ascan.]) 1 Plate. 1905. 12 p. Kr. 0.75.

Bind II.

» 1 C. G. Joh. Petersen: On the larval and post-larval stages of some Pleuronectidæ (Pleuronectes, Zeugopterus.) 1 Pl. 1906. 10 p. Kr. 0.50.

» 2 Johs. Schmidt: The pelagic post-larval stages of the Atlantic species of Gadus. A monograph. Part II. 1 Pl. 1906. 20 p. Kr. 1.00.

» 3 Johs. Schmidt: On the pelagic post-larval stages of the Lings (Molva molva [Linné] and Molva byrkelange [Walbaum]). With 1 Pl. and 3 Figures. 1906. 16 p. Kr. 0.75.

» 4 Johs. Schmidt: On the larval and post-larval development of the Argentines (Argentina silus [Ascan.] and Argentina sphyræna [Linné]) with some Notes on Mallotus villosus [O. F. Müller]. 2 Pl. 1906. 20 p. Kr. 1.50.

» 5 A. C. Johansen: Contributions to the biology of the Plaice with special regard to the Danish Plaice-Fishery. II. The marking and transplantation experiments with Plaice in the years 1903—06. 9 Pl. and 10 Figures. 1907. 122 p. Kr. 5.25.

» 6 Johs. Schmidt: Marking experiments on Plaice and Cod in Icelandic waters. 2 Charts. 23 p.

» 7 Johs. Schmidt: On the post-larval development of the Hake (Merluccius vulgaris Flem.) 1 Pl. 4 Figures. 1907. 10 p. Kr. 1.75.

» 8 Johs. Schmidt: On the post-larval development of some North Atlantic Gadoids (Raniceps raninus [Linné] and Molva elongata [Risso]). 1 Pl. and 1 Fig. 1907. 14 p. Kr. 0.75.

» 9 Johs. Schmidt: On the post-larval stages of the John Dory (Zeus Faber L.) and some other Acanthopterygian Fishes. 1 Plate. 1908. 12 p. Kr. 0.75.

Bind III.

» 1 C. G. Joh. Petersen: On the larval and post-larval stages of some Pleuronectidæ (Zeugopterus, Arnoglossus, Solea.) 2 Plates. 1909. 18 p. Kr. 1.25.

» 2 J. P. Jacobsen and A. C. Johansen: Remarks on the changes in specific gravity of pelagic fish eggs and the transportation of same in Danish waters. 2 Figures. 1908. 24 p. Kr. 0.75.

» 3 Johs. Schmidt: Remarks on the metamorphosis and distribution of the larvae of the Eel (Anguilla vulgaris Turt.). 1 Pl. and 1 Chart. 1909. 17 p. Kr. 1.00.

Nr. 4 A. C. Johansen: Contributions to the biology of the Plaice with special regard to the Danish Plaice-Fishery. III. On the variation in frequency of young Plaice in Danish waters in 1902—07. 12 Figures. 1908. 48 p. Kr. 1.50.

» 5 A. C. Johansen: Do. do. do. IV. Is the Plaice indigenous to the true Baltic? 2 Fig. 1908. 23 p. Kr. 0.75.

» 6 Johs. Schmidt: On the occurrence of Leptocephali (Larval Muraenoids) in the Atlantic W. of Europe. 2 Pl. & 1 Chart. 1909. 19 p. Kr. 1.50.

» 7 Johs. Schmidt: On the distribution of the fresh-water Eels (Anguilla) throughout the world. I. Atlantic Ocean and adjacent regions. A bio-geographical investigations. 1 Chart. 1909. 45 p. Kr. 1.75.

» 8 A. C. Johansen: Bericht über die dänischen Untersuchungen über die Schollenfischerei und den Schollenbestand in der östlichen Nordsee, dem Skagerak und dem nördlichen Kattegat. Mit 10 Figuren im Text. 1910. 142 S. Kr. 4.50.

Bind IV.

» 1 A. C. Johansen: Contributions to the biology of the Plaice with special regard to the Danish Plaice-Fishery. V. The supposed migrations of plaice from the Kattegat and Belt Sea to the true Baltic. 5 Figures. 1912. 34 p. Kr. 1.25.

» 2 Johs. Schmidt: On the identification of Muraenoid larvæ in their early (»Preleptocephaline«) stages. 1 Plate. 1913. 14 p. Kr. 0.75.

» 3 A. C. Strubberg: The metamorphosis of elvers as influenced by outward conditions. Some experiments. 1913. 11 p. Kr. 0. 50.

» 4 A. C. Johansen: Contributions to the biology of the Plaice with special regard to the Danish Plaice-Fishery. VI. On the immigration of plaice to the coastal grounds and fiords on the west coast of Jutland. 1913. 26 p. Kr. 1.00.

» 5 P. L. Kramp: Report on the fish eggs and larvæ collected by the Danish research steamer »Thor« in the Langelandsbelt in 1909. With 6 Figures in the text. 1913. 39 p. Kr. 1.25.

» 6 Bjarni Sæmundsson: Continued marking experiments on plaice and cod in Icelandic waters. 7 Fig. 1913. 35 p. Kr. 1.25.

» 7 Johs. Schmidt: On the classification of the freshwater Eels (Anguilla). 1915. 19 p. Kr. 0.75.

» 8 Ö. Winge: On the value of the rings in the scales of the Cod as a means of age determination. Illustrated by marking experiments. 1916. 21 p. Kr. 0.75.

» 9 A. C. Johansen: Contributions to the biology of the Plaice with speciel regard to the Danish Plaice-Fishery. VII. Marking experiments with plaice in the North Sea off the west coast of Jutland during the years 1906—1912. With supplementary observations on the previous Danish experiments. 27 Fig. 1915. 60 p. Kr. 2.00.

Bind V.

» 1 Johs. Schmidt: Marking experiments with Turtles in the Danish West Indies. With 5 Tables and 11 Fig. 1916. 26 p. Kr. 1.00.

» 2 A. C. Strubberg: Marking Experiments with cod at the Færoes. 24 Fig. 1916. 126 p. Kr. 4.00.

» 3 A. C. Johansen: Marking Experiments with Sole (Solea vulgaris Quensel) and Turbot (Rhombus maximus L.) in the Kattegat and Baltic Waters: 4 Fig. 1916. 18 p. Kr. 0.50.

» 4 Johs. Schmidt: On the early larval stages of the Fresh-Water Eels (Anguilla) and some other North Atlantic Murænoids. 4 Plates and 14 Fig. 1916. 20 p. Kr. 175.

» 5 P. Jespersen: Contributions to the Life-History of the North Atlantic Halibut (Hippoglossus vulgaris Flem.) 1 Plate and 16 Fig. 1917. 32 p. Kr. 1.50.

MEDDELELSER FRA KOMMISSIONEN
FOR DANMARKS FISKERI- OG HAVUNDERSØGELSER
SERIE: FISKERI · BIND X · NR. 1 · 1935

COD MARKING EXPERIMENTS IN THE WATERS OF GREENLAND 1924—1933

BY

PAUL M. HANSEN, AD. S. JENSEN
&
Å. VEDEL TÅNING

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1935

CONTENTS

Page

Introduction 3

Section I.

A. Review of experiments, methods etc..... 5
1. Survey of experiments 1924—33 5
2. Size of Cod marked 9
3. Methods used in fishing Cod for marking ... 10
4. Methods of marking..... 10
5. Methods in recording of recaptures 11

B. Conditions affecting results 12

C. Notes on evidence of periodic alterations in the marine fauna of Greenland 13

Section II. The various Experiments 1924—33.

A. West Greenland 15
I. Experiments 1924 15
Migrations & age and size of migrating Cod.
1. Direction and extent of the migrations 15
2. Time in the sea and rate of migration 18
II. Experiments 1925 18
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 19
2. Time in the sea and rate of migration 22
III. Experiments 1926..... 22
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 23
2. Time in the sea and rate of migration 23
IV. Experiments 1927 25
Migrations & age and size og migrating Cod
1. Direction and extent of the migrations 27
2. Time in the sea and rate of migration 28
V. Experiments 1928 28
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 29
2. Time in the sea and rate of migration 29
VI. Experiments 1929 31
Migrations & age and size of migrating Cod.
1. Direction and extent of the migrations 31
2. Time in the sea and rate of migration 35
VII. Experiments 1930 36
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 37
2. Time in the sea and rate of migration 42
VIII. Experiments 1931 43
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 44
2. Time in the sea and rate of migration 48

Page

IX. Experiments 1932..... 50
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 51
2. Time in the sea and rate of migration 54
X. Experiments 1933 56
Migrations & age and size of migrating Cod
1. Direction and extent of the migrations 57
2. Time in the sea and rate of migration 60

B. East Greenland 60
Experiments 1926—33 60
a. Migrations 62
1. Direction and extent of the migrations ... 62
2. Time in the sea, rate of migration and season of migration 62
b. Age and size of migrating Cod 63
c. Rate of growth in length 63

Section III. General Survey of the marking experiments at Greenland 1924—1933

A. West Greenland 64
1. Localities and date 64
2. Number of fish marked and recaptured 64
3. Size of fish marked 65
4. Depths where recaptures were made..... 65
5. Inshore and offshore markings..... 66
6. Migrations 66
a. Direction and extent of the migrations... 67
b. Differences in migration with localities and years 72
c. Time in the sea and rate of migration ... 75
d. Season of migration 76
e. Periodicity in the interchange with Iceland and causes of the migration 78
7. Size and age of recaptured Cod..... 79
8. Rate of growth in length..... 84
9. Relation to the fishery..... 86

B. East Greenland..... 89

C. Concluding remarks and future work 89

Summary 90

List of literature..... 92

Appendix A. Detailed particulars of liberation and recapture 93

Appendix B. Index list to marking experiments 1924-33 116

Appendix C. Explanation to the Charts..... 117

Dansk Resumé..... 118

INTRODUCTION

Although the marking of Cod in the waters of Iceland was undertaken already in 1905 by the late Professor Johs. Schmidt, shortly after the beginning of the systematic fishery investigations in those rich waters (1903), this method of studying the migrations of Cod was not used at West Greenland until some 20 years later. During the early years of this century the Cod fishing there was of small importance. Towards 1920 however a change for the better occurred, presumably owing to favourable natural conditions for a number of years, and the stock then proved to be of considerable dimensions; so much so that it began to show an ever increasing importance, not only for the native population but also for the fishing fleets of other nations. In view of this, Cod marking experiments have now been carried on for a number of years through the collaboration of "Kommissionen for Danmarks Fiskeri- og Havundersøgelser" and "Grønlands Styrelse", so far as the conditions and means permitted. The very first experiments were made in 1924, when one of the present authors under the instructions of Professor Johs. Schmidt marked 414 Cod at West Greenland. From 1926 Cod have also been marked at East Greenland.

Several of these marking experiments have been mentioned in various preliminary reports of a small character. Ad. S. Jensen (1925, p. 38)[1]) refers to the marking experiments of 1924; the first results were discussed by Ad. S. Jensen (1926, p. 100) and by Ad. S. Jensen & P. M. Hansen (1930, pp. 43—49; 1931, pp. 34—37) as also by Schmidt (1930, pp. 8—10). The last-mentioned author also discusses the experiments and certain results in two later works (Schmidt: 1931 a, p. 6 et seq. and 1931 b, pp. 1009—10). Paul M. Hansen (1931, p. 708; 1932, pp. 902—903; 1933, p. 38 and 1934 a, pp. 235—239) has briefly referred in annual reports to these experiments at West Greenland in connection with other fisheries investigations carried out by him. Further reference to the experiments has been made by Tåning (1934 a, pp. 9—10 and 1934 b, pp. 31—35). As the results mentioned in these various preliminary papers will be included in the present report, their contents need not be further detailed; opportunities will occur later to refer to various statements in these reports.

Simultaneously with the extensive experiments at West and East Greenland the marking of Cod was carried on both at Iceland and the Faroes by "Kommissionen for Danmarks Fiskeri- og Havundersøgelser" (see Schmidt 1931 a and Tåning 1934 a and b). All these marking experiments, together with those of Thor Iversen at Jan Mayen and East Greenland (Iversen 1934), have greatly extended our knowledge of the Cod's wanderings in the North-West Atlantic. At various places in the following report it will be necessary to refer to the results of these experiments, as an interchange of Cod has been found to take place between widely separated

[1]) In the introduction to that paper Johs. Schmidt also mentions the experiment (p. 4).

fishing banks. There are several indications also, that the extensive wanderings of the Cod are subject to a certain amount of periodicity and our aim therefore is to continue the experiments for a longer series of years. For the same reason extensive marking of Cod was recommended by the Meeting of Cod Experts (appointed by the International Council for the Exploration of the Sea) held in Copenhagen 7th to 9th November 1933 (see Rapports et Procès-Verbaux des Réunions, Vol. 89, II, p. 13).

As Cod recaptures from several of the experiments mentioned here may still be expected for some years, the present work can only be regarded as the first part of a series dealing with the same subject. The scattered hydrographical data for the waters of Greenland must also be brought into service, together with some material not yet published; these will be examined and brought together in a publication dealing with the variations in temperature etc. during a series of years.

In the following list (Table 1) we mention those responsible for carrying out the experiments in the different years, both at West Greenland and East Greenland.

Table 1. Details of marking experiments.

West Greenland			East Greenland		
Year	Marker and/or ship	No. marked	Year	Marker	No. marked
1924	Å. Vedel Tåning, Dr. phil	414			
1925	R/S "Dana"	291			
—	Fishery officer L. N. Nielsen . . .	119			
1926	Paul M. Hansen, Cand. mag. . . .	316	1926	Governor A. T. Hedegaard	2
—	Fishery officer J. M. Jensen . . .	26			
1927	Paul M. Hansen, Cand. mag. . . .	201	1927	—	100
1928	— from S/S "Godthaab" . .	109	1928	—	11
1929	Paul M. Hansen, Cand. mag. . . .	500			
1930	—	1454	1930	—	182
1931	—	1408	1931	—	243
—	Lieutenant-Commander Chr. Ries from H. M. S. "Hvidbjørnen"	244			
1932	Paul M. Hansen, Cand. mag. . . .	508	1932	—	34
—	Lieutenant-Commander Chr. Ries from H. M. S. "Maagen" .	97			
—	Skipper Alfr. Egholm from M/S "Suðuroy"	499			
1933	Paul M. Hansen, Cand. mag. . .	475	1933	E. Bertelsen, Stud. mag.	200
—	Skipper Alfr. Egholm from M/S "Suðuroy"	150			
1934	Paul M. Hansen, Cand. mag. . .	520			
—	Mate Jacob Toftum	230			
—	Skipper Alfr. Egholm from M/S "Suðuroy"	204			
	Total	7765		Total	772

In this report we shall not refer to the 1934 experiments in any detail, as the recoveries have been naturally very few so far; in that year 954 Cod in all were marked.

In addition to those mentioned as supervising the marking of Cod, and to whom we are much indebted, various institutions and persons have assisted in many ways in carrying out the work, in collecting information regarding the recaptures of marked fish etc. We may here mention the following especially, whilst expressing our best thanks to one and all, including the many fishermen who have helped the investigations in one way or other.

J. Daugaard-Jensen, Director of the Greenland Government; Colonial Governors and officials in Greenland of the Government; fishery officer L. N. Nielsen, Sukkertoppen; former fishery officer J. M. Jensen, Holstensborg; fishery officer Martin Hansen, Holstensborg; fishery officer P. Larsen, Sydprøven; "Fiskifélag Íslands" through Kristján Bergsson, Dr. Bjarni Sæmundsson and Mag. Árni Friðriksson; the Faroe Government through Amtmand H. Ringberg; shipowner Mrs. E. Müller, Thorshavn; editor P. Niclassen, Thorshavn; Mr. Albin Bærentsen, Thorshavn; Fisheries Laboratory, Lowestoft; Fishery Board of Scotland; Office des Pêches maritimes, Paris; Biol. Anstalt, Helgoland; Fiskeridirektoratet in Bergen; Ministerio da Marinha, Lisbon; Danish Consulate, Trondhjem; Dr. Harold Thompson, Newfoundland and others.

Special thanks are due to "Fiskifélag Íslands", as the many Cod migrants to Iceland have given the Society a good deal of work, with regard to correspondence and the like. We must also use this occasion to thank Capt. G. Hansen and Mrs. Inger Rosenberg for their most valuable assistance in the preparation of charts, lists etc. Special thanks are also due to Dr. H. M. Kyle who has translated this work.

Section I.

A. Review of experiments, methods etc.

1. Survey of experiments 1924—1933.

Particulars of the different experiments are given in the Appendix A, pp. 94—115 where all recaptures up to the present (January 1st, 1935) have been recorded. The positions of the various marking localities are indicated on the Chart Fig. 2, where an attached number refers to the corresponding particulars in the Appendix. The Chart Fig. 1 shows most of the localities referred to in this work.

In the waters of West Greenland the Cod has been recorded as far north as "Prøven" in Upernivik District (about 72°21′ N. Lat., 55°25′ W. Long.)[1]); north of Disko Bay however the species is very rare and met with exceptionally and only in warmer periods. In Disko Bay and neighbouring waters the Cod has been fished for in later years during the present period; but only small quantities have been taken, late in the year (August—October). For this reason we have not yet succeeded in carrying out marking experiments here. As will be seen from the Chart Fig. 2, experiments have been carried out in about 100 localities along the west coast, the most northern at 68° N. Lat., the most southern near Cape Farewell at 60° N. Lat.

[1]) 2 specimens were captured here in 1930.

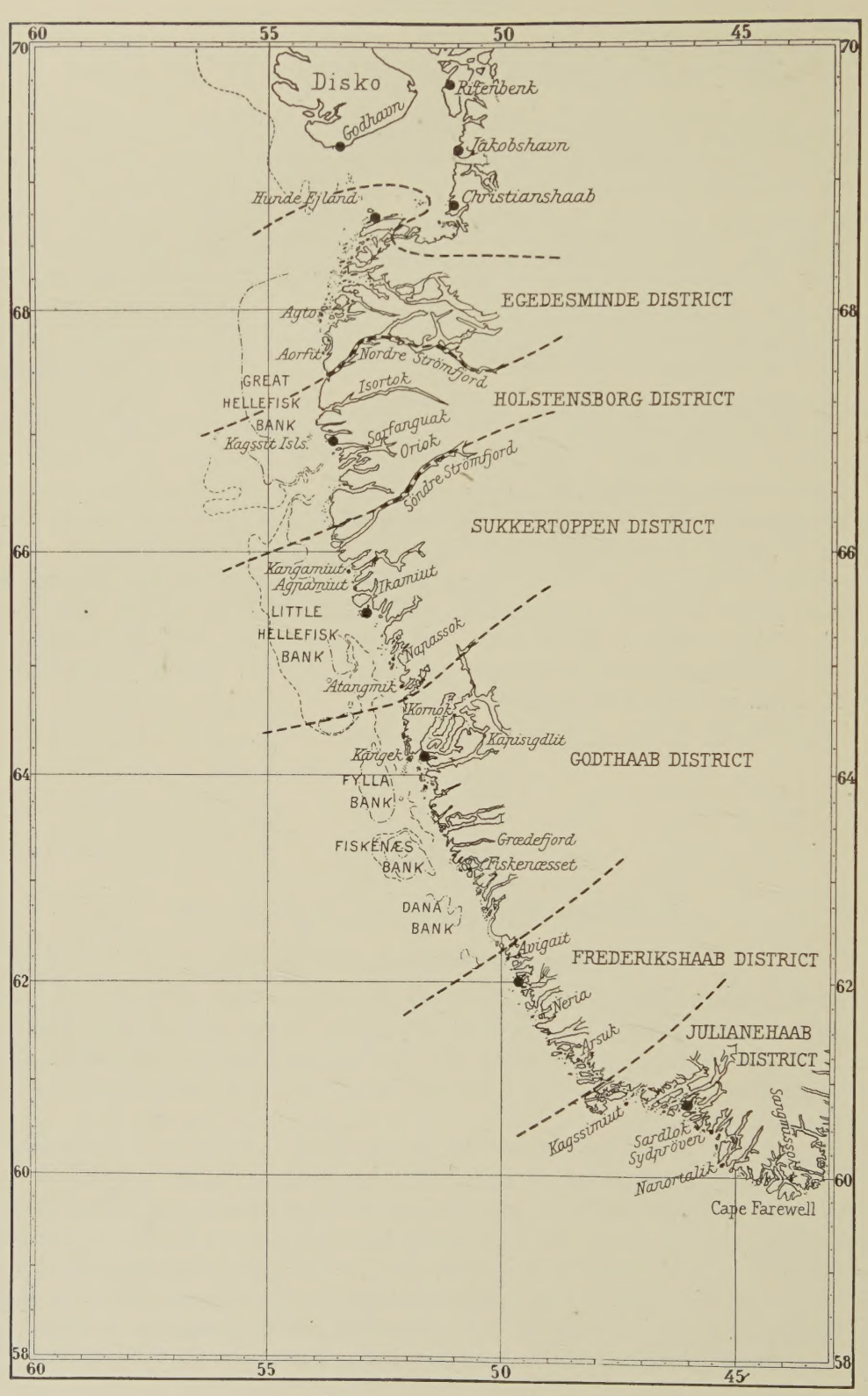

Fig. 1. Chart showing localities referred to in the text. • Colonies.

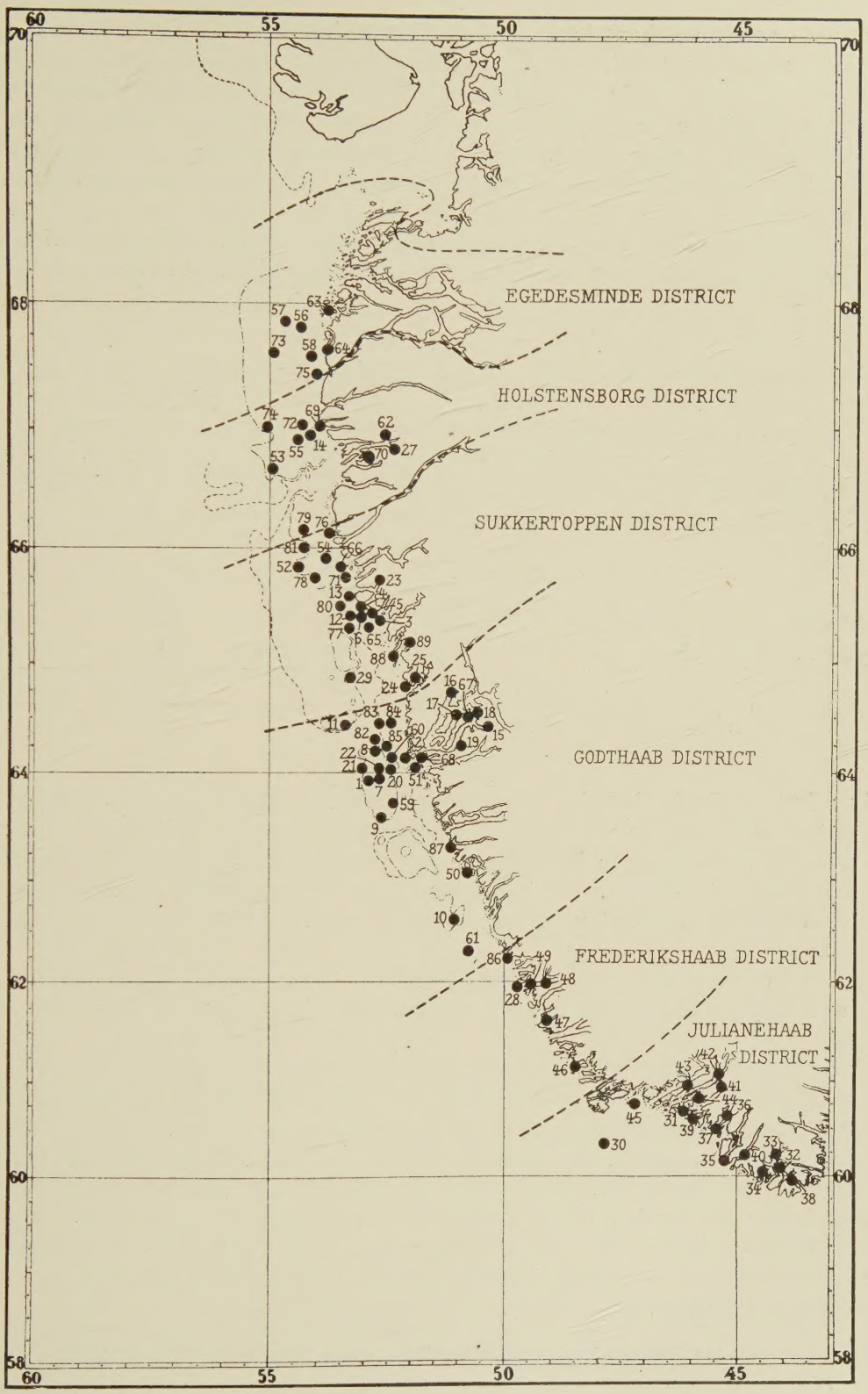

Fig. 2. Localities of marking experiments at West Greenland (see Appendix B, p. 116).

A total of 6811 specimens have been marked here during the years 1924—1933; of these 397 (5.8 %) have been recaptured.

The numbers marked in the different colonies from north to south along the west coast are somewhat various; naturally, the number is lowest in the colony farthest north, Egedesminde, where the Cod begins to decrease greatly in numbers, highest in the colonies of Sukkertoppen, Godthaab and Julianehaab, where the conditions have permitted most of the markings to be carried out.

The table below gives a summary of the numbers of Cod marked in the various districts, and shows also the respective numbers marked in offshore and inshore waters.

Table 2.

District	Total No. of Cod liberated 1924—1933	No. liberated		
		on offshore banks	in coastal waters	in the fjords
Egedesminde	58	33	25	0
Holstensborg	784	545	0	239
Sukkertoppen	1773	760	792	221
Godthaab	1569	619	506	444
Frederikshaab	673	0	348	325
Julianehaab	1954	3	1035	916
Total	6811	1960	2706	2145
Percentage	100	29	40	31

As is known, the bank region along the west coast becomes narrower towards the south, and the coastal banks are thus wanting or of very small extent south of about 62° N. Lat. We see also from the Table that practically no Cod were marked out on the banks in the Frederikshaab and Julianehaab districts, only some banks off the latter being of any importance and even these are usually covered with drift-ice in the summer time; in consequence but few boats fish here.

It will be seen also that the three areas for the marking experiments: offshore, coastal and fjord waters, are each well-represented in the total, with 29, 40 and 31 % respectively.

At East Greenland, where the Cod has been taken in recent years from about Angmagssalik[1]) down to Cape Farewell and where no commercial fishing is carried on by Greenlanders, the Danish marking experiments were made about 66° N. Lat., and only in the inshore waters of Angmagssalik District (see particulars, App. A, p. 114). During the years 1926—1933 a total of 772 Cod have been marked and liberated here; of these only 8 have been recaptured. Thor Iversen has also marked fish in these waters (vide Iversen 1934, pp. 12—13); 200 Cod were liberated 3—4, August 1931 off Angmagssalik (65°23′ N. Lat., 37°53′ W. Long.) and of these 10 specimens were recaptured at Iceland up to May 29th, 1934, according to Thor Iversen (International Meeting, June 1934).

[1]) Farther out in the Denmark Strait however the Cod has been taken more to the north (see e. g. Braarud & Ruud 1932, pp. 9—12).

2. Size of Cod marked.

The marking experiments were chiefly made on Cod of over 50 cm. in size; mature Cod and those nearing maturity were specially chosen. The reason for this naturally was, that the main problem the marking experiments were intended to throw light on, concerned the spawning migrations of mature Cod. Next came the study of the food wanderings, both of mature and immature Cod, then the study of the growth etc.

Excluding the first two years the marking experiments at West Greenland have been based mainly on Cod of the year-classes 1922, 1924 and 1926, which during nearly the whole period have contributed the main portion of the stock there. This is shown very clearly by the age-analyses of Cod from the coastal areas and banks, these analyses being carried out during the whole period at West Greenland (cf. Ad. S. Jensen & P. M. Hansen 1930, p. 28 et seq.; 1931, p. 22 et seq.; P. M. Hansen 1931, p. 707 et seq.; 1932, p. 902 et seq.; 1933, p. 32 et seq.; 1934, p. 226 et seq.; Tåning 1933, p. 7).

In the accompanying lists (Tables 3 and 4) we have brought together the data regarding size of all Cod marked in each single year, both for West Greenland and East Greenland; the length is indicated in 5-cm. groups. Later in this work, on dealing with the experiments of the different years, we shall consider more closely the size of the Cod marked at the various localities; the age of the Cod will also be discussed.

Table 3. Length of Cod marked at West Greenland 1924—1933.

5-cm. groups Year:	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total
135—139 ...	..	..	..	..	..	..	1	..	..	..	1
130—134 ...	1	..	..	..	..	..	..	2	..	..	3
125—129 ...	3	..	1	..	..	..	3	3	1	..	11
120—124 ...	12	7	1	..	..	1	6	7	3	..	37
115—119 ...	11	9	2	..	1	4	4	8	7	1	47
110—114 ...	21	28	2	3	2	7	9	21	7	..	100
105—109 ...	10	44	8	1	4	1	4	34	18	3	127
100—104 ...	9	41	13	..	8	4	12	58	40	5	190
95—99 ...	6	35	7	3	3	2	13	101	73	13	256
90—94 ...	12	36	12	7	5	3	52	154	152	35	468
85—89 ...	25	49	16	7	16	13	101	163	133	90	613
80—84 ...	54	58	20	12	22	18	143	155	188	113	783
75—79 ...	69	46	9	21	32	49	148	154	131	125	784
70—74 ...	53	35	5	23	14	82	183	200	153	105	853
65—69 ...	42	11	16	49	1	74	223	257	131	64	868
60—64 ...	36	10	56	39	1	39	308	181	44	25	739
55—59 ...	27	1	102	27	..	111	179	108	15	19	589
50—54 ...	19	..	69	9	..	86	58	42	2	11	296
45—49 ...	4	..	1	..	..	4	7	1	1	8	26
40—44 ...	..	..	..	..	..	..	..	1	..	5	6
35—39 ...	..	..	..	..	..	..	..	..	..	1	1
? ...	..	..	2	..	..	2	..	2	5	2	13
	414	410	342	201	109	500	1454	1652	1104	625	6811

Table 4. Length of Cod marked at East Greenland 1926—1933.

5-cm groups	Year: 1926	1927	1928	1930	1931	1932	1933	total
110—114	..	..	..	1	..	..	..	1
105—109	..	..	..	..	..	..	..	..
100—104	..	..	..	2	..	1	..	3
95—99	1	1	..	..	1	..	1	4
90—94	..	1	..	..	3	..	4	8
85—89	..	1	..	5	9	..	7	22
80—84	..	..	..	13	15	2	13	43
75—79	..	5	2	12	10	3	29	61
70—74	..	10	1	12	38	2	40	103
65—69	..	36	2	22	43	7	33	143
60—64	..	34	2	37	46	6	31	156
55—59	1	7	4	45	28	6	14	105
50—54	..	5	..	24	24	4	14	71
45—49	..	..	..	9	19	3	6	37
40—44	..	..	..	..	6	..	6	12
35—39	..	..	..	..	1	..	1	2
?	..	..	..	..	..	..	1	1
	2	100	11	182	243	34	200	772

3. Methods used in fishing Cod for marking.

Experience gained at the Faroes and Iceland has taught us, that Cod taken carefully on hand-lines are on the whole best suited for marking. The material from Greenland has thus been collected almost entirely by means of the jigger, especially the Faroese hand-line[1]). The method has varied somewhat in the different years and localities. During the first year the marking was carried out in a laborious manner with assistance from the Greenlanders, these fishing in kajaks or quite small boats and bringing the fish to a small rowing or motor boat, where the jigger-caught fish were carefully transferred, then measured and marked by the marker. The same method was used in a few localities in 1926. In the marking experiments of the "Dana" in 1925 jigger-caught fish were also used. In the following years the work was carried out from the motor boats of the Greenland Government ("Otho Fabricius", "Misilîssok", "Umarissok" and others) or other vessel of larger size (ss. "Godthaab", fishery cruiser "Hvidbjørnen", fishery patrol boat "Maagen", ms. "Suðuroy").

4. Methods of marking.

The Cod were always marked immediately on capture (not kept in a tank for some hours), but any fish badly wounded by the jigger were left out, so that only fish considered fully able to live were liberated. The Cod taken from deeper water sometimes have difficulty in getting down again, owing to the pressure of gas in the air-bladder; in many cases these were relieved by pricking the air-bladder from the side and letting the gas escape.

It cannot be avoided however, even with careful exclusion of all badly damaged specimens, that some Cod do not survive the handling; but from the experiments carried on through

[1]) In a few localities nets and long-lines were used (see Appendix A, p. 96 and p. 114).

many years we have gained the impression, that the percentage lost in this way is very small. One may note also, that these marking experiments at Greenland are carried out in water of low temperature, so that infection through wounds from the jigger or mark is much less frequent than in the warmer waters farther south. In all the present experiments the marks were of ebonite, as used for many years.

The method of marking has changed but little during the experiments. Whilst the needle described by TÅNING 1933, was not used in 1924 and only in imperfect form in 1925, it has since been used every year. By using the marking needle the mark can be fixed to the gill-cover in a better way and more securely; this can be seen clearly from the fact, that recaptures have been made up to 8 years after the marking.

During the marking process the length of the fish is noted in cm., also in certain cases the weight; and the sex has been indicated where the condition of maturity permitted its determination. In addition, other necessary details were taken down (locality, date etc.).

5. Methods in recording of recaptures.

In most years the records from Greenland have come through the Governors of the colonies and fishery officers, who were instructed by the Government with regard to the information required. The premium for each mark has been 2 Kroner plus postage, a fairly high reward according to the conditions prevailing in Greenland, and it is probable therefore that all marks seen or found by the Greenlanders have been sent in. Unfortunately the reliability of the information is not as great as one might desire.

At Iceland the collection of the records was made chiefly through the "Fiskifélag Íslands"; from the fishing vessels of other countries the marks have usually been received through the respective fishery departments. From the Faroes the records were obtained mostly from the Government Bureau, officials or the fishermen themselves. In the later years we have tried to obtain better information by posting up notices, sending these round with drawings and list of questions etc. For example, the question paper was given to all the Faroese cutters that fish at Greenland and the placards were delivered by "Fiskifélag Íslands" to the Icelandic trawlers and so on. Further, articles on the marking experiments were inserted in the local newspapers and magazines, emphasizing everywhere the kind of information desired, so that knowledge of the experiments might spread among the common fishermen. We have found also, that this activity has repaid itself, partly in yielding better information and also in the return of a number of marks which might otherwise through indifference have remained with the fishermen.

In the Laboratory the recaptures were noted in journals and also on charts in a register, a method that materially aided the working up of the material. All particulars of the Cod recaptured are given in the list in Appendix A, pp. 94—115.

As the length measurements were uncertain in certain cases (especially in the earlier years before figures were issued showing how the Cod were to be measured), the fishermen often giving the length as measured from neck to end of tail or from snout to "Spole" (root of caudal fin) and so on, we have been obliged to reject a number of the measurements. In regard to the data of sex one must be careful of their use, as the ordinary person is often uncertain with regard to the inner characters of sex. A note at the beginning of the Appendix will give some necessary explanations of the abbreviations used and the like.

B. Conditions affecting results.

The results obtained from the marking experiments, like all others of the same kind, contain certain unavoidable errors and we may make a brief reference here to various shortcomings, which have to be taken into account in estimating the value of some of the results. From the places of marking the Cod have spread out over a wide area in the North Atlantic, a very large percentage migrating to Iceland. In this way they have come into areas where to some extent quite different methods of fishing are employed, and this naturally must affect for example the percentage of recaptures, which means again that the percentages from the two areas cannot be compared directly. At Greenland, on the banks, in coastal waters and the fjords, the Cod is everywhere mainly caught by means of the jigger (Faroese hand line) and long lines, very few of the fishermen using the gill-net etc. At Iceland, on the other hand, the trawl fishery is very considerable and likewise the net fishery at the Westmanna Islands during the spawning period; long lines are also used on all the coasts, whereas the jigger is used to a much less extent, comparatively speaking (practically by the Faroese cutters and some French fishing boats only).

Whilst the marked Cod taken by jigger and to some extent those taken on the long lines and in nets may readily be noticed by the fishermen in most cases, this is much less probable with the trawl caught Cod which are dealt with more quickly, as soon as they come on board, often in rough weather. On the trawler the crew work on the open deck when gutting the Cod, frequently in a bad light and often tired out with the hard labour. We can be certain therefore, that the recaptures of marked Cod at Iceland are really greater than the numbers indicate. To this must be added, that the premium has not the same value for the trawlers as for the Greenlanders, for example, and that the ordinary trawl fishermen of other countries are not so interested in the Cod investigations as the Faroese are, almost without exception. The records of the Cod actually recaptured are thus in some cases nearly exact, in others too low owing to the different methods of fishing and the different countries concerned. In one case we know that a fisherman, instead of returning the mark, has kept it as an amulet! This has possibly happened in several cases and our records are short in consequence.

Further, in estimating the value of the results we have to note, that the intensity of fishing is very different in the various areas to which the marked Cod have wandered from Greenland. Thus, whilst it is very great along certain stretches of the coasts of Iceland, for example, it is practically non-existent along the south-eastern part of Greenland, which the marked Cod must undoubtedly pass by in great numbers. Even on the west coast of Greenland, where the fishing on the whole is much less than at Iceland, we find almost all degrees of intensity. We must constantly have this difference in mind when comparing the different areas mentioned.

In this connection again we have to note, that whilst the trawl fishery at Iceland, for example, is carried on the whole year round, even if less intensively in certain months, at Greenland the Cod fishery during recent years has been practically dead in the cold season[1]); this also naturally must reduce the percentage of recaptures at Greenland by comparison with Iceland. The Cod marking at Greenland was carried on mainly in the period July to October (cf. Table 5); since the percentage of recovered fish is always higher in the first year than later, one has also to note, that at Greenland especially the percentage is greatly affected by the time of year when the marking took place; thus whether early in the season or in September—

[1]) In recent years there has been very little fishing in the winter along the coasts or in the fjords, and practically none on the banks in the period November to June.

October when the fishery ends, not specially owing to lack of fish but owing to the difficult conditions along West Greenland in regard to weather and ice.

Table 5. Number of Cod marked at West Greenland in the months May to November in the years 1924—1933.

No. of Cod	May	June	July	August	September	October	November	Total
marked..	210	285	1329	2900	1181	902	4	6811

As usual also we must make certain allowances for the information supplied by the common fishermen; consequently, wherever we have had any reason to doubt such information, and it could not be verified in other ways, we have preferred to leave it out altogether or placed a question mark opposite it.

On marking, the length of the Cod was supposed to be indicated to the nearest, lower whole cm. and this procedure may be said to have been followed by the scientific assistants and some others who have taken part in the experiments, but possibly not in all cases by others who may have taken the length to the nearest cm.; this is of no great significance naturally, as living Cod of large size cannot be measured exactly and a difference of a few cms. may easily arise.

C. Notes on evidence of periodic alterations in the marine fauna of Greenland.

In the following pages we shall have occasion to note at several places, how the occurrence and wanderings of the Cod at Greenland may be considered subject to various changes from one period to another, to a much greater extent for example than at Iceland or Norway. These may be ascribed undoubtedly to changes in the temperature of the sea, the currents etc. It may be of interest therefore to interpolate a few observations here which show, that the present period is a warm period. How far this may be of short or long duration it is naturally impossible for us to say at present, as the investigations in these waters have only been carried on for about 25 years, far too short a period to permit of sufficient empirical data being collected for the determination of such an important question.

In an earlier paper Jensen & Hansen (1931, pp. 3—10) have discussed the history of the Greenland Cod fishery and illustrated the great fluctuations it has undergone in the preceding and present centuries, rich Cod periods alternating with poor Cod periods. The present rich period is characterised not only by the extraordinary abundance of Cod at the southern part of West Greenland but by the occurrence also of other species of fish belonging to southern climes, regarded from the Greenland point of view. We may mention, for example, the Coalfish or Green Cod (*Gadus virens*); since far back in the previous century this had not been noticed at Greenland, yet in recent years since 1924 it has been taken not rarely in the company of Cod shoals and even seems to have spawned at Greenland. At some places the one-year old Coalfish have been taken in very large quantities. Again, such a fish as the Haddock (*Gadus aeglefinus*) has appeared there, and the Herring (*Clupea harengus*), otherwise almost unknown at Greenland, has been found in certain of the southern fjords in recent years, sometimes in large shoals. Both small Herring (I-group) and the large have been observed, some of the latter with running eggs and milt; the deposited eggs have also been found. The Picked Dog-fish (*Squalus acanthias*), previously a great rarity, has been taken several times in recent years (even with fully developed embryos) and of the deep-sea Atlantic Dealfish (*Trachypterus arcticus*), previously only once recorded from Greenland, no fewer than 8 specimens have been stranded at South Greenland in the years 1923—34.

It is also significant that, whilst southern species have arrived up at Greenland, the otherwise common Arctic species have retired farther north, e. g. the Capelan (*Mallotus villosus*) and the Greenland Halibut (*Reinhardtius hippoglossoides*). Further reference to these conditions will be found in Jensen & Hansen (1931, pp. 39—40).

The whales provide further evidence of these distributional changes within recent years; thus, the Ca'ing Whale (*Globiceps melas*) has since 1926 become a more frequent guest in the summer months than before and a large shoal of this species even remained for the whole winter of 1931—32 in the neighbourhood of Utorkarmiut (Godthaab District), the first time these whales have been known to winter at Greenland. The reverse has been the case with the White Whale (*Delphinapterus leucas*); this usually passes the summer in the far north, coming southwards in the autumn to winter about the Polar Circle along the west coast. In recent years however it has hardly been seen so far south in the winter, but has been observed to prolong its stay in the north.

The adjacent area of Iceland has also in recent years displayed changes in the fauna which can hardly be ascribed to anything but a rise in the temperature of the sea. Bjarni Sæmundsson has discussed these conditions in a work published recently (Probable influence of changes in temperature on the marine Fauna of Iceland. Rapports et Procès-Verbaux des Réunions, Vol. 86. Scientific Report of the North-Western Area Committee for 1930—32, pp. 1—6).

With regard to the northward movement of the Cod itself at West Greenland the following information may be of interest in this connection. In the latter part of the last and in the beginning of the present century the Cod occurred in few places only and in small numbers at Southwest Greenland, but since 1917 it has been much more abundant and has extended over far greater areas than earlier, first in the southern districts of Julianehaab and Godthaab, since 1919 in the Godthaab District, since 1922 in the Sukkertoppen District, and finally, from 1927 in the Holstensborg District too. Thus we see that the increasing frequency and distribution of the Cod have taken place gradually and pronouncedly in a direction from south to north.

The northgoing movement of the Cod has been continued in the succeeding years. Whereas formerly only scattered occurrences of Cod have been noted from the localities about Disko Bay, in recent years large numbers have appeared there in shoals and a commercial fishery has been carried on through the Greenland Government.

It was not until 1928, at the end of July, that the Cod appeared in shoals along the coast from Agto to Hunde Ejland in Disko Bay and Akunak (a little east of Egedesminde). In the immediately preceding years it had not reached farther than to Iginiarfik (ca. 68°10′ N.) and then only in small numbers. In 1929 the Cod was found everywhere in the Egedesminde District at the beginning of July, and large quantities remained there through the whole summer. In 1930 the Cod appeared in the southern part of Egedesminde District and at Hunde Ejland in the first half of July, at Akunak towards the end of that month; large shoals were present throughout the summer and autumn. In 1931 the Cod appeared in commercial quantities in Egedesminde District, at most places about the 7th of July, at other places about the middle of the month or later. Further, commercial dealings were carried on at several places in Disko Bay (at Ikamiut, Akugdlet, Christianshaab, Claushavn and Ritenbenk). At Godhavn there was but little trading, the Cod not arriving here until the middle of September. This year it reached the Umanak District (north of 70°); it appeared about July 25, but in small numbers; on August 2, shoals were noticed. In 1932 the Cod did not appear in the Umanak District until the first days of September; at Ritenbenk on August 24, at Christianshaab July 22, and at Godhavn in September; in the Egedesminde District at most places by the middle of July.

In 1933 the Cod were noticed moving close to land at Umanak in the beginning of September. They appeared at Ritenbenk in the end of August, at Christianshaab on July 21, and at Egedesminde in the end of July. For 1934 we have no information from Umanak. At Ritenbenk the Cod appeared first in the beginning of September, also at Godhavn; at Christianshaab on July 19, and at Egedesminde about the middle of July.

Section II.

The various Experiments 1924—33.

A. West Greenland.

I. Experiments 1924.

In this year, the first year of such experiments at Greenland, 414 Cod in all were marked at the following places and times:

Fylla Bank, 24, June	8	spec.
Mouth of Godthaab Fjord, 1—2 & 30, July	124	—
Near Sukkertoppen, 12, Aug.—2, Sept.	282	—

For details see Appendix A, p. 94.

Apart from the few marked out on the Fylla Bank all were marked in the coastal waters, none farther inside the fjords.

The size of the fish marked is shown in the accompanying curves (Fig. 3), which however do not include the few Cod from the Fylla Bank; these had a length of 81—110 cm. and belonged probably to the year-classes 1912—1917. The majority of the fish belonged to the year-class 1917 but in small part also to the years 1919 and 1920, some (especially from Godthaab) to even older year-classes about 1909—1915 (cf. Jensen & Hansen 1930, p. 30 and 1931, p. 25). The majority have thus been certainly still immature fish (up to 7 years old), as maturity in most cases here is not reached till the 8th year or later.

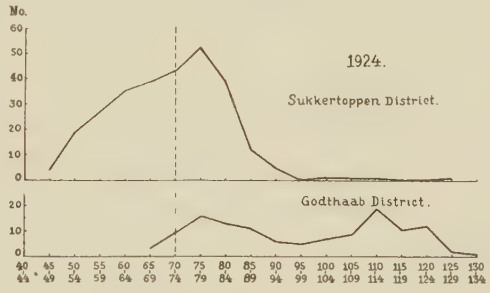

Fig. 3. Size of Cod marked 1924.

Of these 414 marked Cod 16 altogether have been recaptured, thus only 3.9 %; 14 were retaken at Greenland, 2 at Iceland. The first Cod to indicate that migration could take place from Greenland to Iceland belonged to this year's experiment (No. 385 marked at Sukkertoppen and recaptured off Faxebugt 1927). We were very sceptical about this recapture to begin with, though further information received from the fisherman (S. Johannsson, "Namdal", Reykjavik) by Dr. Bjarni Sæmundsson confirmed that no mistake had been made. It was not until three years later (1930) that recaptures were again reported from Iceland and thus definitely proved this interesting migration between the two regions; later, abundance of evidence was forthcoming.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Chart Fig. 4 shows the migrations of the Cod marked in 1924. As mentioned above, two marked at Sukkertoppen have migrated to Iceland, thus almost certainly southwards along the west coast then along the east coast and across to Iceland over the deep-sea ridge

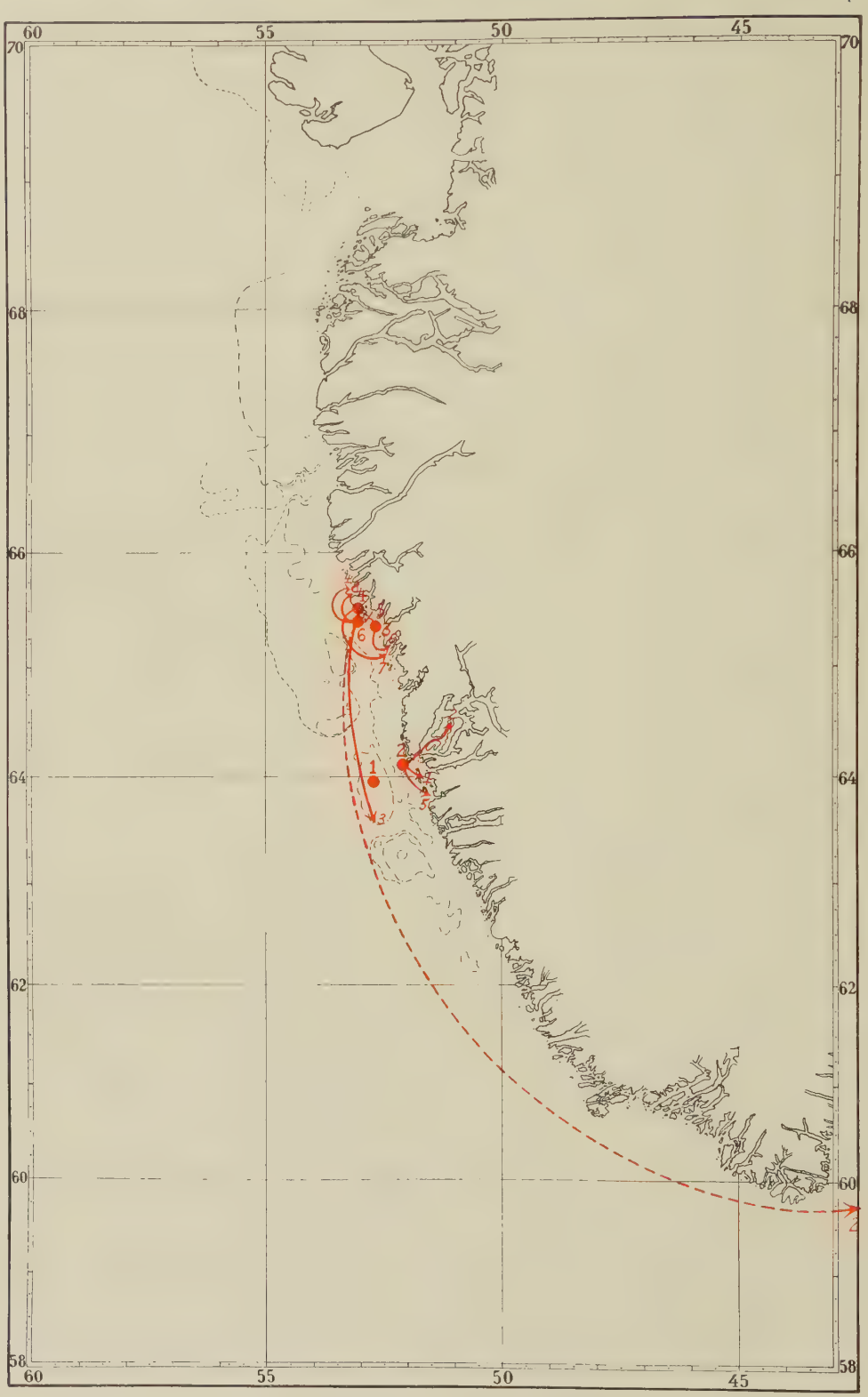

Fig. 4. Migrations of Cod marked **1924.**

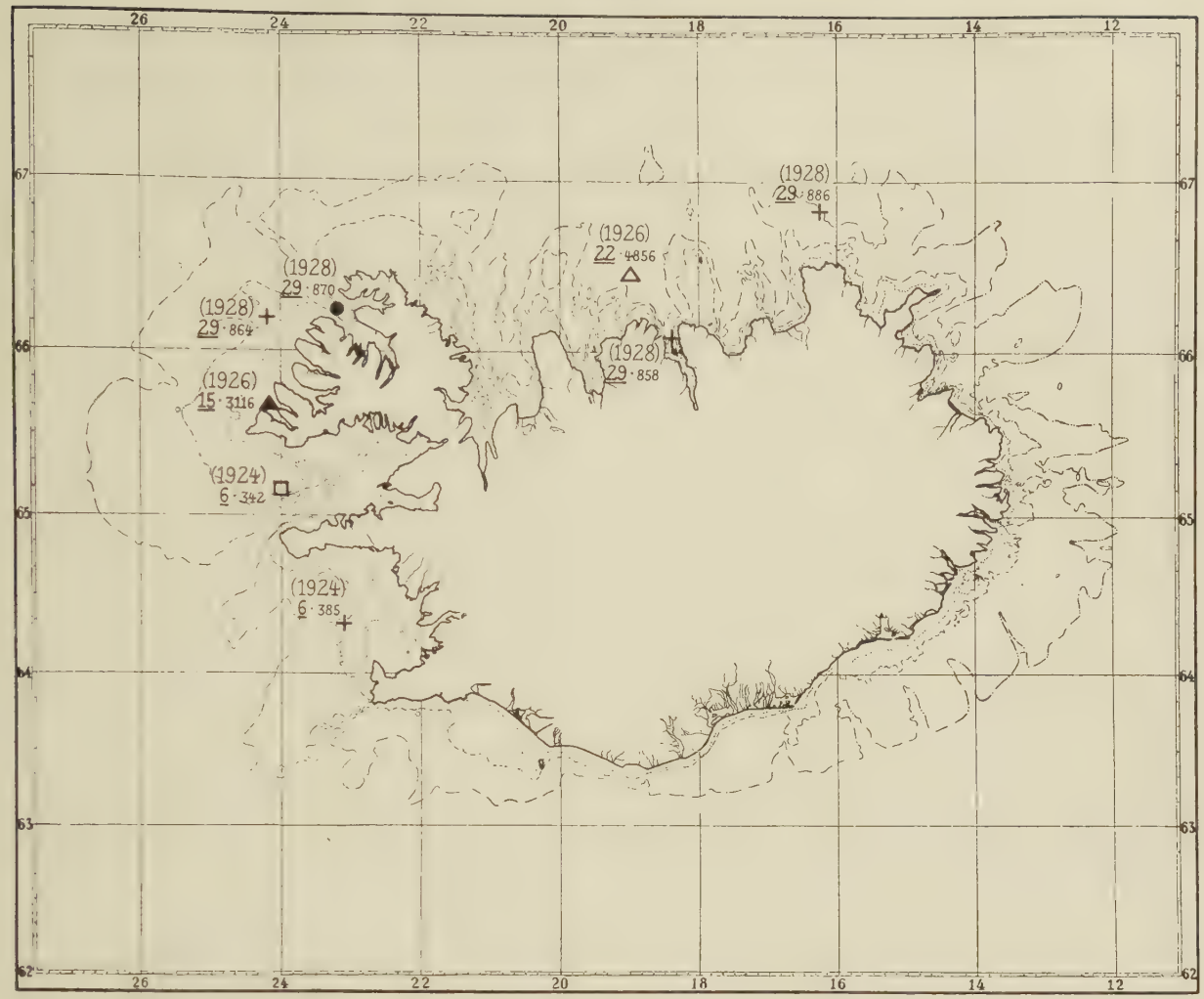

Fig. 5. Emigrants to Iceland from marking experiments **1924—1928**. ● specimens recaught 2 years, + 3 years, ▲ 4 years, △ 5 years and □ 8 years after marking.

Marking-experiments 1924.

Exp. No.	Month	No./Rec.	Recaptures from Greenland (see Fig. 4). 1924	1925	1926	1927	1928	1929	1930	1931	1932
1.	June	8/1	—	—	—	—	—	7*	—	—	—
2.	July	124/6	61[1]	—	103[2]	116*	—	86*	—	—	—
						15*					
						44[5]					
3.	Aug.	9/2	—	—	138*	135[6]	—	—	—	—	—
4.	Aug.	14/1	—	—	—	—	147[7]	—	—	—	—
5.	Aug.	28/0	—	—	—	—	—	—	—	—	—
6.	Aug.— Sept.	231/4	—	—	343[3]	271*	—	—	—	339[8]	—
					346[4]						
	Total	414/14	1	—	4	5	1	2	—	1	—

Exp. No.	Month	No./Rec.	Recaptures from Iceland (see Fig. 5). 1924	1925	1926	1927	1928	1929	1930	1931	1932
1.	June	8/0	—	—	—	—	—	—	—	—	—
2.	July	124/0	—	—	—	—	—	—	—	—	—
3.	Aug.	9/0	—	—	—	—	—	—	—	—	—
4.	Aug.	14/0	—	—	—	—	—	—	—	—	—
5.	Aug.	28/0	—	—	—	—	—	—	—	—	—
6.	Aug.— Sept.	231/2	—	—	—	385	—	—	—	—	342
	Total	414/2	—	—	—	1	—	—	—	—	1

* Stationary. 61[1], 103[2] etc., see Appendix C., p. 117.

between East Greenland and Northwest Iceland. The distance travelled has been at least 1050—1100 miles; both specimens were retaken on the west coast of Iceland (see Fig. 5). One was caught after 31 months and had grown from 70 to 78 cm.; the other was recaptured not less than 92 months after marking (5. May 1932) and had grown from 56 to 95.5 cm.; the age of these emigrants is not known. One of the remainder has travelled a good distance (ca. 100 miles) within the Greenland area, from Sukkertoppen to the Fylla Bank, thus showing a southward migration like the two mentioned above. The rest were retaken close to the place of marking or less than 40 miles away. The specimen that travelled about 40 miles is of interest in that it had migrated from the mouth of Godthaab Fjord a long distance up this fjord; here a local spawning has been found to take place (see Ad. S. Jensen 1926, p. 90). A summary of the migrations is given in Table 6.

Table 6. Direction of migrations 1924.

	No. marked	Stationary[1])	Migrated North	Migrated South	Migrated to Iceland
Sukkertoppen	282	4	0	3	2
Godthaab	124	4	1[2])	1	0
Fylla Bank	8	1?	0	0	0
	414	9 (8?)	1	4	2

2. Time in the sea and rate of migration.

Only one of the recaptures was made in the year of marking (near the place of marking); the others were retaken in later years, up to the 8th year (92 months), after marking. The recaptures in the different years are shown in the following Table (the number of specimens taken at Greenland + Iceland, e. g. 5 + 1).

Table 7. Number of Cod recaptured during the different years after marking (1924).

No.		1	2	3	4	5	6	7	8	9	10	11	
marked		1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	Total
414	No. recapt	1+0	0+0	4+0	5+1	1+0	2+0	0+0	1+0	0+1	0	0	14+2

Six (or seven) specimens were retaken almost at the same place where they were marked; they have remained there up to 5 years (64 months) after marking and all were large Cod (80—ca. 115 cm.).

The two specimens that wandered farthest (both immature when marked, 70 and 56 cm. long) were retaken in the 4th and 8th year respectively; we have thus no indication of their rate of migration.

II. Experiments 1925.

In this year 410 Cod in all were marked, 291 from R/S "Dana" out on the banks and 119 by fishery officer L. N. Nielsen in the coastal waters near Sukkertoppen. None were marked farther inside the fjords. The place and date of marking are indicated below.

[1]) Migrations < 20 miles.

[2]) Migrated into fjord.

Sukkertoppen, 30, July—20, August ..... 119 spec.
Little Hellefisk Bank, 13, July ..... 51 —
Fylla Bank, 4, July—6, July ..... 180 —
Dana Bank, 11, July ..... 60 —

For further details see Appendix A, p. 94.

The size of the marked fish is shown in the accompanying curves (Fig. 6). It will be noted that the Cod marked out on the banks are on the whole much larger than those in Sukkertoppen District. On the banks the year-classes of 1909[1]), 1912 and 1917 (see JENSEN & HANSEN 1930, p. 30 and 1931, p. 25) have yielded most material for the marking, whilst the Sukkertoppen Cod apparently have belonged mainly to the years 1920, 1919 and 1917 (but age analyses are wanting for 1925). Thus in this year mature Cod chiefly have been marked on the banks, immature Cod in the coastal waters.

Of the 410 Cod marked 41 specimens in all have been recovered, thus 10 $^0/_0$; all retaken at Greenland, none at Iceland. The possible explanation of this is, that the majority were marked out on the banks and were large mature fish spawning at West Greenland.

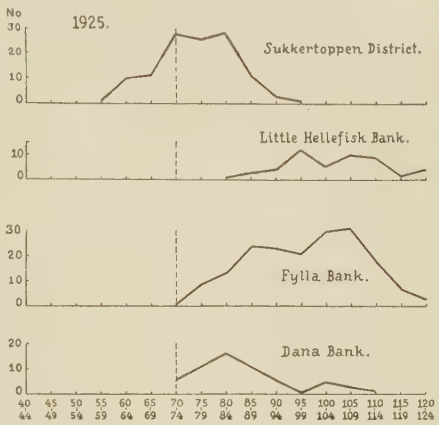

Fig. 6. Size of Cod marked 1925.

Table 8. Direction of migrations 1925.

	No. marked	Stationary[2])	Migrated North	Migrated South	Migrated to Iceland	Locality unknown
Sukkertoppen	119	2	1	3	0	1
Little Hellefisk Bank	51	1	3	1	0	1
Fylla Bank	180	20	3	3	0	0
Dana Bank	60	1	1	0	0	0
	410	24	8	7	0	2

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Chart, Fig. 7, shows the wanderings undertaken by the Cod marked in 1925. In contrast to the results from almost all the other years not a single specimen marked in 1925 at West Greenland was returned from Iceland (cf. 1927 experiments also). A large proportion (about $^3/_4$ ths) of this year's marked fish were recaptured within a fairly short time after marking and almost at the same place where they were liberated; the reason being, that these Cod were marked by R/S "Dana" out on the banks at the beginning of the season, and that a large fleet of fishing boats happened to be working there just in that year.

As will be seen from the Chart and Tables the wanderings to the south have been of short extent (< 50 miles), whereas 8 specimens have travelled a considerable distance northwards (up to about 200 miles). The recapture of the latter has occurred only 3—8 years after

[1]) A revision of the material has shown that the year-class 1909, not 1910 as given in the paper cited, was predominant.

[2]) Migrations < 20 miles.

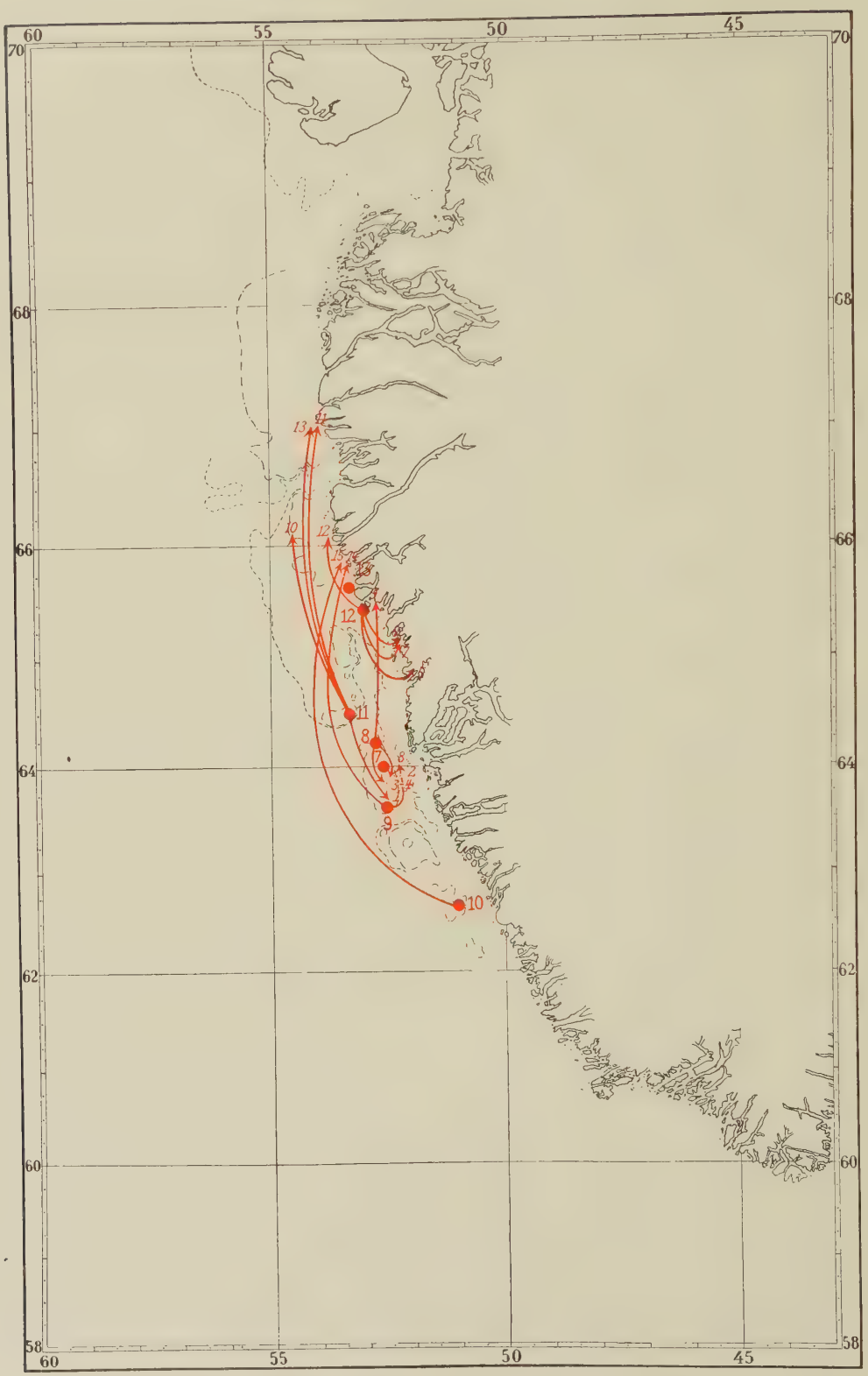

Fig. 7. Migrations of Cod marked **1925**.

marking, namely in 1928: 1 spec., 1929: 1 spec., 1930: 2 spec., 1931: 3 spec. and 1933: 1 spec. As we shall see from the following experiments, part of the stock found at West Greenland migrates northwards over the banks (probably during the summer mainly); at least this seems to occur periodically in most years. Of the 8 specimens referred to 5 have travelled 100 miles or more and it is worth noting, that these were all large fish (95—112 cm. on marking, 104—130 cm. on recapture); the remaining 3 which have gone shorter distances than 100 miles (20, 36 and 70 miles) were on the other hand 89, 74 and 78 cm. in length when marked (ultimate length 97, ?, ?). It is also well-known to the fishermen who work on the West Greenland banks, that the large Cod are to be found in the north. Possibly therefore these Cod of large size wander about after spawning there, but do not migrate so far as the somewhat smaller, spawning Cod which travel between Greenland and Iceland.

The age is only known of some few (6), almost stationary fish; these were from 6—13 years old when marked, 11—13 years on recapture.

Marking-experiments 1925.

Recaptures from Greenland (see fig. 7).

Exp. No. Month	No./Rec.	1925	1926	1927	1928	1929	1930	1931	1932	1933
13.										
Aug.....	52/1	—	—	—	—	—	—	—	3033†)	—
12.										
July.....	67/6	—	2986[5]	—	—	2961*	—	2974[12]	—	—
Aug.....			2990[6]			2984*				
			3007[7]							
11.										
July.....	51/6	2901[1]	—	—	—	—	2921[10]	2905[13]	—	—
		2934*					2944[11]			
		2943†)								
8.										
July.....	77/6	2538[2]	2603*	—	2539*	2596[9]	—	—	—	—
		2583[3]								
		2593[4]								
7.										
July.....	28/4	2502*	—	—	—	—	—	—	—	—
		2516*								
		2518*								
		2528*								
9.										
July.....	75/16	2621*	2613*	2616*	2649[8]	—	—	2607[14]	—	—
		2629*	2617*	2622*						
		2636*	2618*							
		545*	2650*							
		778*	760*							
			768*							
			1538*							
10.										
July.....	60/2	—	—	—	—	—	1589*	—	—	1571[15]
Total...	410/41	15	11	2	2	3	3	3	1	1

Recaptures from Iceland:
nil.

†) Locality unknown. *) Migration < 20 miles.

2. Time in the sea and rate of migration.

No fewer than 15 specimens were recaptured in the same year, due as mentioned to the fairly intensive fishery that year on the banks where the marking was mainly carried out. In the following year 11 were retaken; thereafter the number falls but is almost the same (1—3) in all the following years till 1933, when a single specimen was retaken no less than $96^1/_2$ months after marking. As noted above, not one was retaken at Iceland.

Table 9. Number of Cod recaptured during the different years after marking (1925).

No.		1	2	3	4	5	6	7	8	9	10	
marked		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	Total
410	No recapt....	15	11	2	2	3	3	3	1	1	0	41

A few specimens were taken 3—4 years after marking very near the place of liberation; both medium and large fish were among these (showing that wandering to great distances does not apply uniformly to all specimens of a certain size-group). We have mentioned above, that the specimens marked this year which have wandered to a great distance at West Greenland were some 4—8 years in the sea before recapture. From these recaptures we obtain no information regarding the rate of travel, as the period when the migration began is not known.

The recaptures from the marking experiment of 1925 were in the first years made close to the place of marking, and no great migrations have apparently taken place. In 1930—33 however we have a relatively large number of recaptures from north of the marking places (in all 7 that have migrated far northwards), thus pointing to extensive wanderings in a northerly direction. It may be emphasized again, that the Cod marked in this year were mainly large old Cod (year-classes 1909, 1912, 1917).

III. Experiments 1926.

The number of Cod marked and liberated in 1926 amounted to 342 specimens; most were marked in the fjords (231), fewer on the banks (109) and only 4 in the coastal waters. The following are the data of place and time (see also App. A, p. 96).

Great Hellefisk Bank, 16—20, July	26 spec.
Ikamiuts Kangerdluarssuk in Sukkertoppen Dis., 3, Aug.	50 —
Atangmik & Angmasivik in Sukkertoppen Dis., 7—8, Aug.	50 —
Fylla Bank, 27—30, July	83 —
Interior of Godthaab Fjord, 25, June—8, July & 25—27, Aug.	131 —
Fiskenæsset, Godthaab District, June	2 —

Excluding the sample from Great Hellefisk Bank the lengths of the marked Cod are given in the curves Fig. 8. For practical reasons the material is arranged according to districts. These curves indicate very clearly, that the lengths of the great majority lie between 50—65 cm., thus immature Cod, which applies specially to the Sukkertoppen District. It is the exceedingly abundant 1922 year-class which has reached the size mentioned in 1926 as the IV-group and completely dominates the other year-classes (see Jensen & Hansen 1930, pp. 30—32 & 1931, pp. 24—25). From the Godthaab Fjord we have but few larger Cod of ca. 70—100 cm. and practically all these were taken in gill-nets at Kapisigdlit in the interior of the fjord, where there

is a spawning ground, as noted on a previous occasion[1]). These are probably large Cod which have spawned in here and have remained after spawning in pursuit of large quantities of Capelan which arrived here in June.

On the Fylla Bank almost as many large as small were marked. The small were of the same year-class as those in the fjords, i. e. 1922 year-class, whilst the large were probably mainly of the 1917 and 1912 year-classes, which were found dominant on the banks in the previous year.

Only 8 of the 342 marked Cod from this year have been recaptured, thus only 2.3 %. Of these 6 were retaken at Greenland and 2 at Iceland. The Iceland recaptures were not made until 1930 and 1931, thus 4 and 5 years after marking.

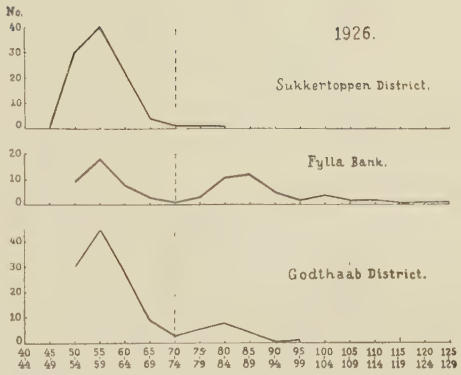

Fig. 8. Size of Cod marked 1926.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The migrations of the Cod marked in 1926 are shown on the Chart Fig. 9. Of the 2 recaptured at Iceland (see Fig. 5) one was marked at Kapisigdlit in the interior of Godthaab Fjord and retaken at N.W. Iceland in May 1930, whilst the other was marked on the Fylla Bank and retaken at N. Iceland in 1931, also in the month of May. The distance from the place of marking to place of recovery amounts to about 1100 miles.

These two Cod were 55 and 58 cm. long on marking and thus belonged with certainty to the 1922 year-class. On recapture at Iceland they would thus have an age of 8 and 9 years respectively, the age when Cod mature in this area; their size had increased to 87 and 81 cm. respectively. Their migrations had probably taken place during the winters of 1929—30 and 1930—31.

With regard to the six recaptures at Greenland, five occurred quite near the place of liberation. The only migration of any interest is that of a large Cod from the bank off Holstensborg into the Amerdlok Fjord as far as Sarfanguak, a distance of about 40 miles from the banks to the interior of the fjord. The specimen had been 5 years in the sea and was 119 cm. long on recapture. No recaptures were made from six coastal stations and two stations on the Fylla Bank.

Table 9. Direction of migrations 1926.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Great Hellefisk Bank .	26	0	1[2])	0	0
Sukkertoppen Distr. . .	100	1	0	0	0
Godthaab Distr.	133	4	0	0	1
Fylla Bank	83	0	0	0	1
	342	5	1	0	2

2. Time in the sea and rate of migration.

From the year of marking itself we have only one recapture, from near the place of liberation and after about 4 months; three were retaken in the following year, 2 four and 2 five years after liberation. In the following summary (Table 10) the recaptures (2) at Iceland are also included.

[1]) Jensen 1926, pp. 90—91; Jensen & Hansen 1930, p. 14 and 1931, p. 10.

[2]) Migrated into the inner part of a fjord.

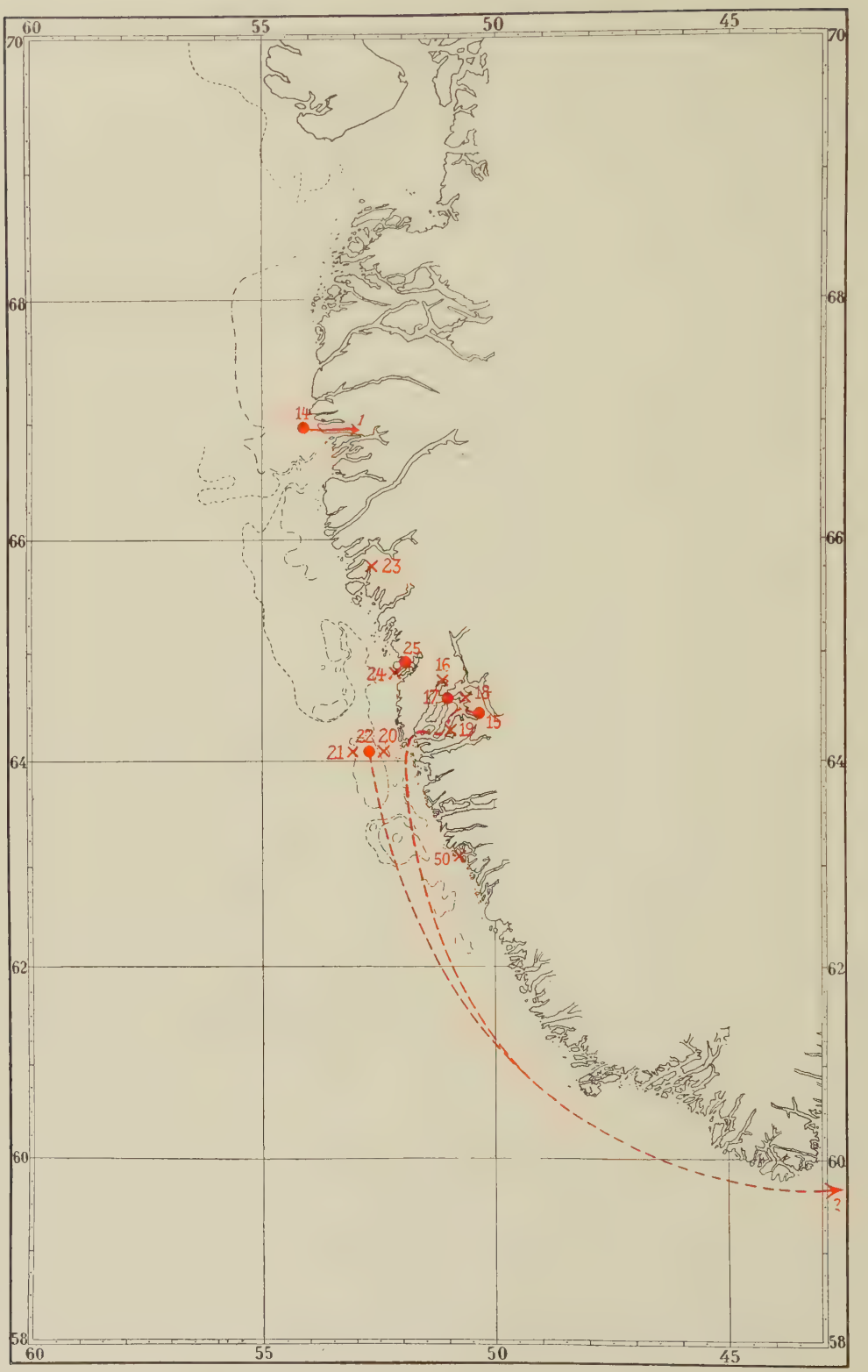

Fig. 9. Migrations of Cod marked **1926.**

Marking experiments 1926.

Exp. No. Month	No./Rec.	Recaptures from Greenland (see Fig. 9). 1926	1927	1928	1929	1930	1931	1932	1933	1934
14. July	26/1	—	—	—	—	—	799[1]	—	—	—
23. Aug.	50/0	—	—	—	—	—	—	—	—	—
25. Aug.	46/1	—	4963*	—	—	—	—	—	—	—
24. Aug.	4/0	—	—	—	—	—	—	—	—	—
16. July	16/0	—	—	—	—	—	—	—	—	—
17. Aug.	47/2	—	4997*	—	—	4990*	—	—	—	—
18. July	6/0	—	—	—	—	—	—	—	—	—
15. June	23/23	109*	3111*	—	—	—	—	—	—	—
19. July	39/0	—	—	—	—	—	—	—	—	—
20. July	13/0	—	—	—	—	—	—	—	—	—
22. July	49/0	—	—	—	—	—	—	—	—	—
21. July	21/0	—	—	—	—	—	—	—	—	—
50. June	2/0	—	—	—	—	—	—	—	—	—
Total	342/6	1	3	—	—	1	1	—	—	—

Exp. No. Month	No./Rec.	Recaptures from Iceland (see Fig. 5, p. 17). 1926	1927	1928	1929	1930	1931	1932	1933	1934
14. July	26/0	—	—	—	—	—				
23. Aug.	50/0	—	—	—	—	—	—	—	—	—
25. Aug.	46/0	—	—	—	—	—	—	—	—	—
24. Aug.	4/0	—	—	—	—	—	—	—	—	—
16. July	16/0	—	—	—	—	—	—	—	—	—
17. Aug.	47/0	—	—	—	—	—	—	—	—	—
18. July	6/0	—	—	—	—	—	—	—	—	—
15. June	23/1	—	—	—	—	3116	—	—	—	—
19. July	39/0	—	—	—	—	—	—	—	—	—
20. July	13/0	—	—	—	—	—	—	—	—	—
22. July	49/1	—	—	—	—	—	4856	—	—	—
21. July	21/0	—	—	—	—	—	—	—	—	—
50. June	2/0	—	—	—	—	—	—	—		—
Total	342/2	—	—	—	—	1	1	—	—	—

Table 10. Number of Cod recaptured during the different years after marking (1926).

No. marked		1 1926	2 1927	3 1928	4 1929	5 1930	6 1931	7 1932	8 1933	9 1934	Total
342	No. recapt....	1+0	3+0	0	0	1+1	1+1	0	0	0	6+2

In the experiment of this year the latest recapture of a stationary Cod took place after four years. The specimen was 55 cm. long on marking (assuredly of the 1922 year-class) and 70 cm. on recapture. Other two stationary Cod (retaken in 1927) also belonged certainly to the same year-class; they measured 55 and 61 cm. on marking, whilst another, also recaptured in 1927, was larger, namely 75 cm. on liberation (1919 year-class?). This one was retaken at Kapisigdlit in May, thus at a period when spawning was probably not yet finished in this locality (cf. HANSEN 1934b, pp. 9—10). The only Cod of this batch which has migrated to some little distance within the Greenland area, about 40 miles, was retaken about 5 years after liberation, as already mentioned; it was recaptured inside the fjord at Sarfanguak after travelling from the banks.

IV. Experiments 1927.

In 1927 only 201 Cod in all were marked at West Greenland, at two fjord and one coastal station. No Cod were marked out on the banks this year. The localities were as follows:

Oriok in Ikertok Fjord (Holstensborg Distr.), 25, May,.... 80 spec.
Kapisigdlit in Godthaab Fjord, 14, Sept..... 26 —
Frederikshaab, 22—23, July..... 95 —

* Migrations < 20 miles.

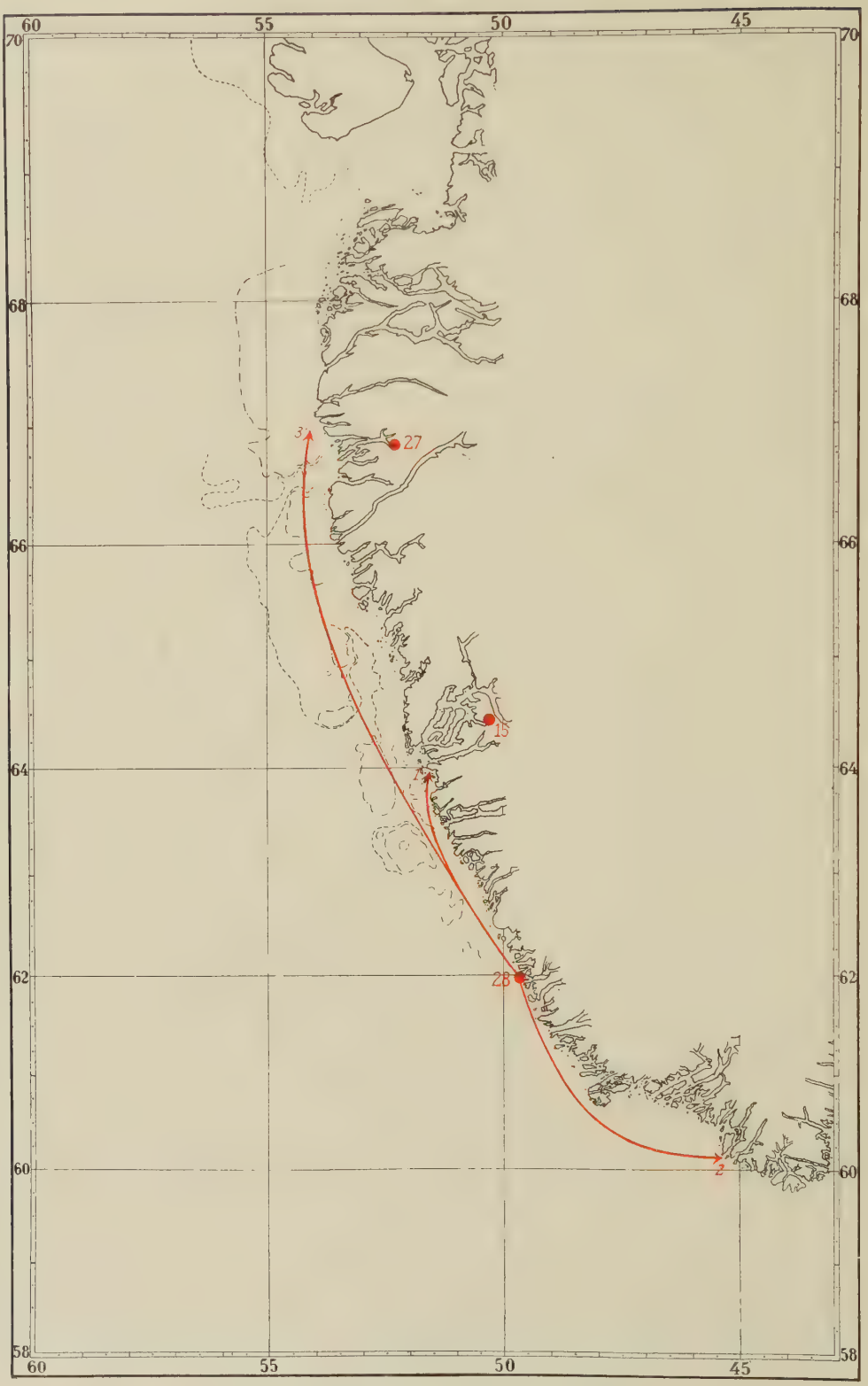

Fig. 11. Migrations of Cod marked **1927.**

The measurements of the marked Cod, just as for the other years, are shown in curves Fig. 10. The specimens from Godthaab Fjord and Frederikshaab were mainly between 50 and 75 cm. in length, whilst those from Ikertok Fjord, Holstensborg District, were on the whole larger, from 55 to 95 cm., mostly 75—80 cm. The former, from Frederikshaab and Godthaab Fjord, were assuredly like those of the previous year, mainly Cod of the 1922 year-class, thus still immature. In the Ikertok Fjord this year-class has certainly not been so important, the Cod being mostly of the 1917, 1919 and 1920 year-classes. Unfortunately we were unable this year to collect material for age determinations in this locality. Some of the Cod were mature, however, as could be seen from the running milt, but no ripe females with running eggs were observed. At this locality in the year in question gill-nets were used in the fishery, in contrast to almost all other fishing places at Greenland. The fishery with long-lines and jigger gave no results as the fjord was filled at the time with spawning Capelan (*Mallotus*) which the Cod were pursuing.

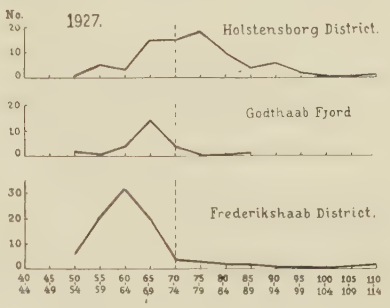

Fig. 10. Size of Cod marked 1927.

Of the 201 Cod marked 12 recaptures in all have been made, thus about 6 %; all recaptures were from Greenland. No Cod of this year's marking have as yet been reported from Iceland. See App. A, p. 96.

MIGRATIONS & AGE AND SIZE OF THE MIGRATING COD

1. Direction and extent of the migrations.

The migrations of the Cod marked in 1927 are indicated on the Chart Fig. 11. As mentioned, recaptures from Iceland are wanting.

Table 11. Direction of migrations 1927.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Holstensborg Distr. . . .	80	8	0	0	0
Godthaab Distr.	26	1	0	0	0
Frederikshaab Distr. .	95	0	2	1	0
	201	9	2	1	0

Marking experiments 1927.

Exp. No.		Recaptures from Greenland (see Fig. 11).							
Month	No./Rec.	1927	1928	1929	1930	1931	1932	1933	1934
27.									
May	80/8	5018*	5081*	—	—	—	—	—	5066*
		5045*							
		5060*							
		5063*							
		5082*							
28.		5101*							
July	95/3	—	5363[1]	—	5134[2]	—	–	—	
15.					5148[3]				
Sept.	26/1	—	5404*	—	—	—	—	—	—
Total . . .	201/12	6	3	—	2	—	—	—	1

Recaptures from Iceland: nil.

* Migrations < 20 miles.

Within the Greenland area three Cod display extensive migrations; all three were marked at Frederikshaab. Two have wandered northwards and were retaken 1 and 3 years after liberation; one has gone southwards and was recaptured about 3 years after marking. The first (a young fish of about 70 cm. in length) was caught at Narssak in the Godthaab District and had thus travelled about 130 miles. The second (a large fish of 96 cm.) has also gone northwards, as far as Kagssit Islands off Holstensborg, which is about 325 miles from the marking place. The third Cod showing a long migration has gone southwards and was recaptured in the spring of 1930 at Nanortalik, about 168 miles from the place of marking. The direction would indicate that this individual was on its way to Iceland but had stopped migrating for some reason or another. Its size on recapture was however about 110—120 cm., which is above the size of Cod that generally undertake the migration from Greenland to Iceland or *vice versa;* it is thus best perhaps to regard the migration of this Cod as simply a wandering about within the area.

The remaining nine recaptures were made very close to the place of marking; in most cases they concern immature individuals.

2. Time in the sea and rate of migration.

In the year of marking itself no fewer than six recaptures were made, thus one half of the total. All were retaken close to the place of liberation. The latest recapture from this experiment was made in 1934, 85 months or about 7 years after marking. As noted above, not one was retaken at Iceland.

Table 12. Number of Cod recaptured during the different years after marking (1927).

No.		1	2	3	4	5	6	7	8	
marked		1927	1928	1929	1930	1931	1932	1933	1934	Total
201	No. recapt...	6	3	0	2	0	0	0	1	12

The six recaptures in the first year were made at Oriok in the Ikertok Fjord; from this locality we have no fewer than 8 out of the 80 marked, thus 10 %. In addition to the 6 taken in the first year one was recaptured in 1928 and one in 1934; these also were retaken at the place of marking. The individual taken in 1934 had grown from 80 to 111 cm. The Cod marked in 1927 at Oriok are probably to be regarded as a race belonging to that Fjord, which spawns within the fjord at Oriok. According to fishing experiments Cod occur here all the year round. In the winter Cod are fished for through holes in the ice in the Ikertok Fjord, both off the outlying Sarfanguak and farther inside off the houses at Sarkadlit. Some of these Cod are taken in May—June with fully ripe sexual organs, often with running milt or eggs.

At Kapisigdlit in the Godthaab Fjord one specimen was retaken in the following year at the place of marking; it had grown from 88 to 90 cm. and may be considered to have been mature. As noted previously, there is a spawning area at Kapisigdlit and the date of recapture (2, June) lies within the spawning time of the Cod here.

Of the three individuals that travelled some distance one was retaken in the following year, date unknown, the other two were recaptured three years after marking. From such data we can conclude nothing as to the rate of migration.

V. Experiments 1928.

In 1928 the marking was carried out from the Expedition-vessel "Godthaab". As the main object of the Expedition was to investigate the northern part of Baffin Bay, but little time was left for the southern waters of Greenland and only 109 Cod were marked. Of these

106 were marked on the Little Hellefisk Bank (3, October) and 3 on the Julianehaab Bank (10, October). No Cod were marked in coastal waters or fjords. The size of the Cod marked is shown in the curve Fig. 12.

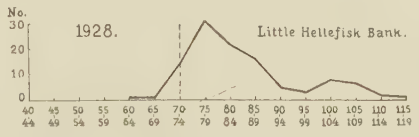

Fig. 12. Size of Cod marked 1928.

Almost all the Cod marked were of fair size; most lay between 70 and 89 cm., a smaller number between 95 and 110 cm. From the age analyses of this year it was learnt, that the 1917 and 1922 year-classes were specially numerous on the Little Hellefisk Bank (see JENSEN & HANSEN 1930, pp. 30 & 33 and 1931, pp. 25—26).

Of the 109 Cod marked 4 have been recaptured, thus about 3.7 %. All were retaken at Iceland; not one from the waters of Greenland. See App. A, p. 98.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The migrations of the Cod marked in 1928 are represented on the Chart Fig. 13, p. 30. We see that none has been noted from Greenland, whilst 4 were retaken in Icelandic waters (see Fig. 5, p, 17). All 4 were marked on the Little Hellefisk Bank and were recaptured at N.W. and N. Iceland in April, May and June. The distance travelled has been about 1050 to 1260 miles. Of the 3 individuals marked on the Julianehaab Bank none has been recaptured. We may conclude from the distribution of the recaptures at Iceland, that the migration from Greenland has led the Cod along the deep-sea ridge, between Angmagssalik and N.W. Iceland, to the N.W. and N. of that island. The specimen retaken on the eastern part of N. Iceland (No. 886, see Fig. 5, p. 17) was captured late in June; it has assuredly come there in pursuit of food after perhaps spawning off N.W. Iceland. The same holds good probably for No. 858, which was taken off Eyjafjord (N. Iceland) in the middle of May.

Table 13. Direction of migrations 1928.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Little Hellefisk Bank	106	0	0	0	4
Julianehaab Bank	3	0	0	0	0
	109	0	0	0	4

2. Time in the sea and rate of migration.

As mentioned, all the recaptures were from Iceland.

Table 14. Number of Cod recaptured during the different years after marking (1928).

No. marked		1 1928	2 1929	3 1930	4 1931	5 1932	6 1933	7 1934	Total
109	No. recapt.	0	0	0+1	0+3	0	0	0	0+4

Of the 4 recaptures one is from 1930, the first year that marked Greenland Cod were retaken at Iceland in considerable numbers. The fish has been 18 months in the sea and has travelled a distance of at least 1080 miles. The migration has probably taken place during the winter of 1929—30. The other 3 are from 1931, about 31—32 months after liberation. All 4 were medium-sized migrating Cod, measuring on liberation 77, 79, 81 and 85 cm., on recapture respectively 86, 88, ?, and 100 cm.; we have no age determinations of any of the individuals. As noted, they were retaken at Iceland in April, May and June, 2 in April the principal spawning period at Iceland.

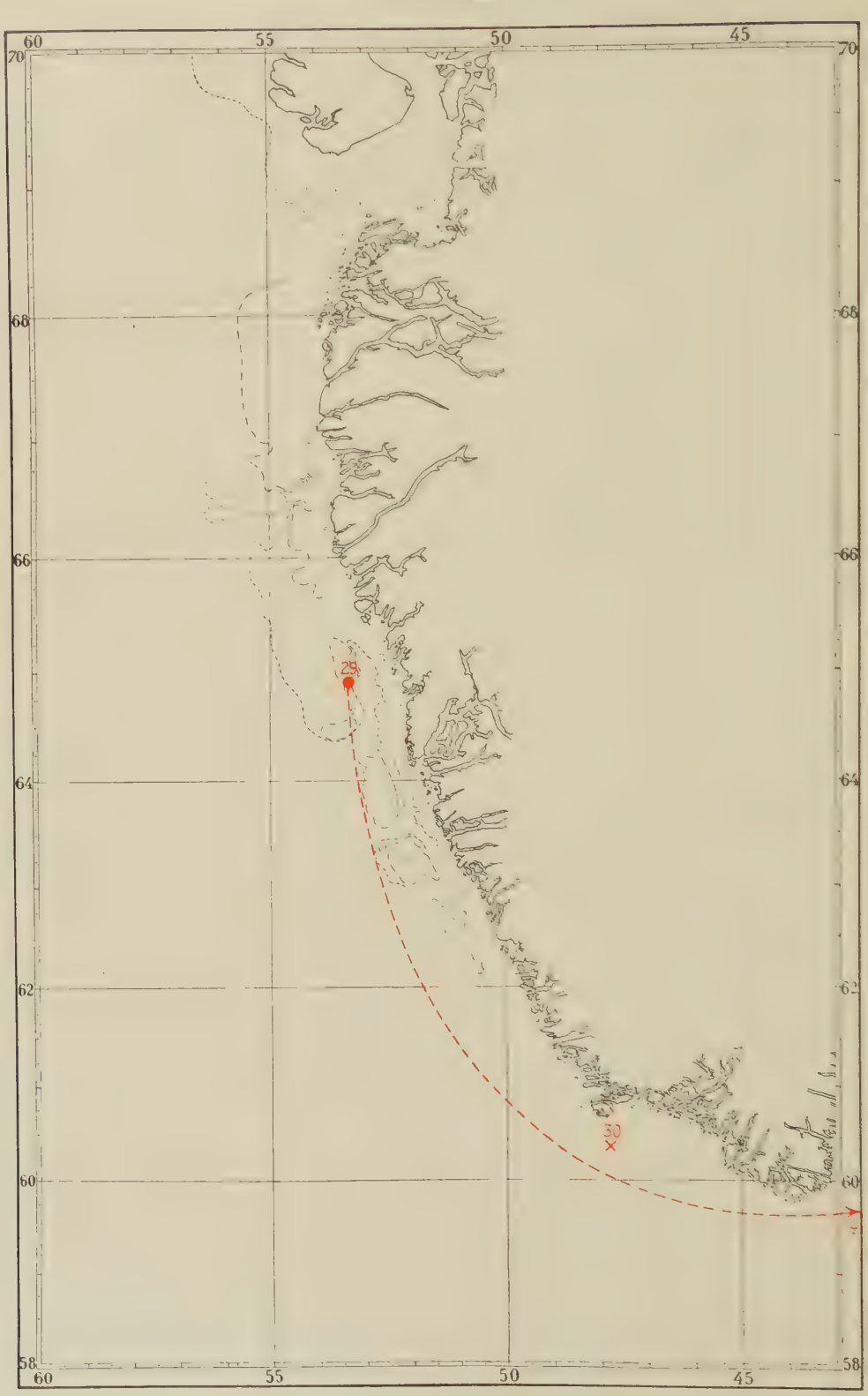

Fig. 13. Migrations of Cod marked **1928.**

Marking experiments 1928.

Recaptures from Greenland: nil.

Exp. No.		Recaptures from Iceland (see Fig. 5, p. 17).						
Month	No./Rec.	1928	1929	1930	1931	1932	1933	1934
29.								
Octbr.	106/4	—	—	870	858	—	—	—
					864			
					886			
30.								
Octbr.	3/0	—	—	—	—	—	—	—
Total...	109/4	—	—	1	3	—	—	—

VI. Experiments 1929.

In August—October of this year 500 Cod in all were marked from the motor-boat "Otho Fabricius", all in the southern Julianehaab District, where no marking experiments had been made before.

Information with regard to locality, date of marking and numbers marked is given in the following summary.

Julianehaab, 22—24, August	119	spec.
Anordluitsok, 6, September	5	—
Kangikitsok Fjord, 7—13, September	54	—
Ujaragssuit in Torsukatak Sound, 16, September	10	—
Nanortalik, 18—20, September	62	—
Unartok Fjord, 3, October	44	—
Agdluitsok Fjord (Lichtenau Fjord), 3, October	11	—
Off Sydprøven, 5, October	120	—
Ikek Sound at Sangmissok, 10—11, October	75	—

No Cod were marked on the banks this year; all were taken in coastal waters or the fjords.

The curve of measurements Fig. 14 indicates that the Cod marked were of uniformly medium size with lengths between 50 and 80 cm.; but few really large individuals were marked. The dominant year-classes this year have been those of 1922 and 1924, especially the former (see JENSEN & HANSEN 1930, pp. 31, 36, Fig. 4 and 1931, pp. 25, 27, Fig. 4). The Cod marked have thus been mainly five and seven years old. The former have undoubtedly for the most part only become mature three or more years after the marking, and the seven years olds have assuredly only become mature in the following or next following year, so far as the majority of them was concerned.

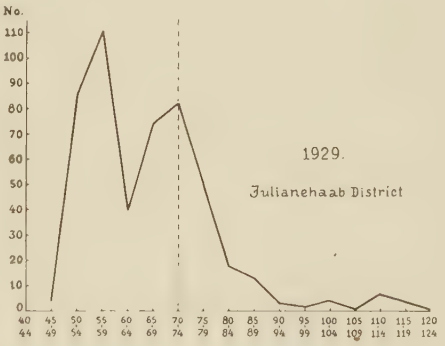

Fig. 14. Size of Cod marked 1929.

Of the 500 Cod marked altogether 34 have been recaptured, a percentage of 6.8; at Greenland 16 were retaken, 18 at Iceland. See App. A, p. 98.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Charts Fig. 15 and Fig. 16 indicate the migrations of the Cod marked in 1929.

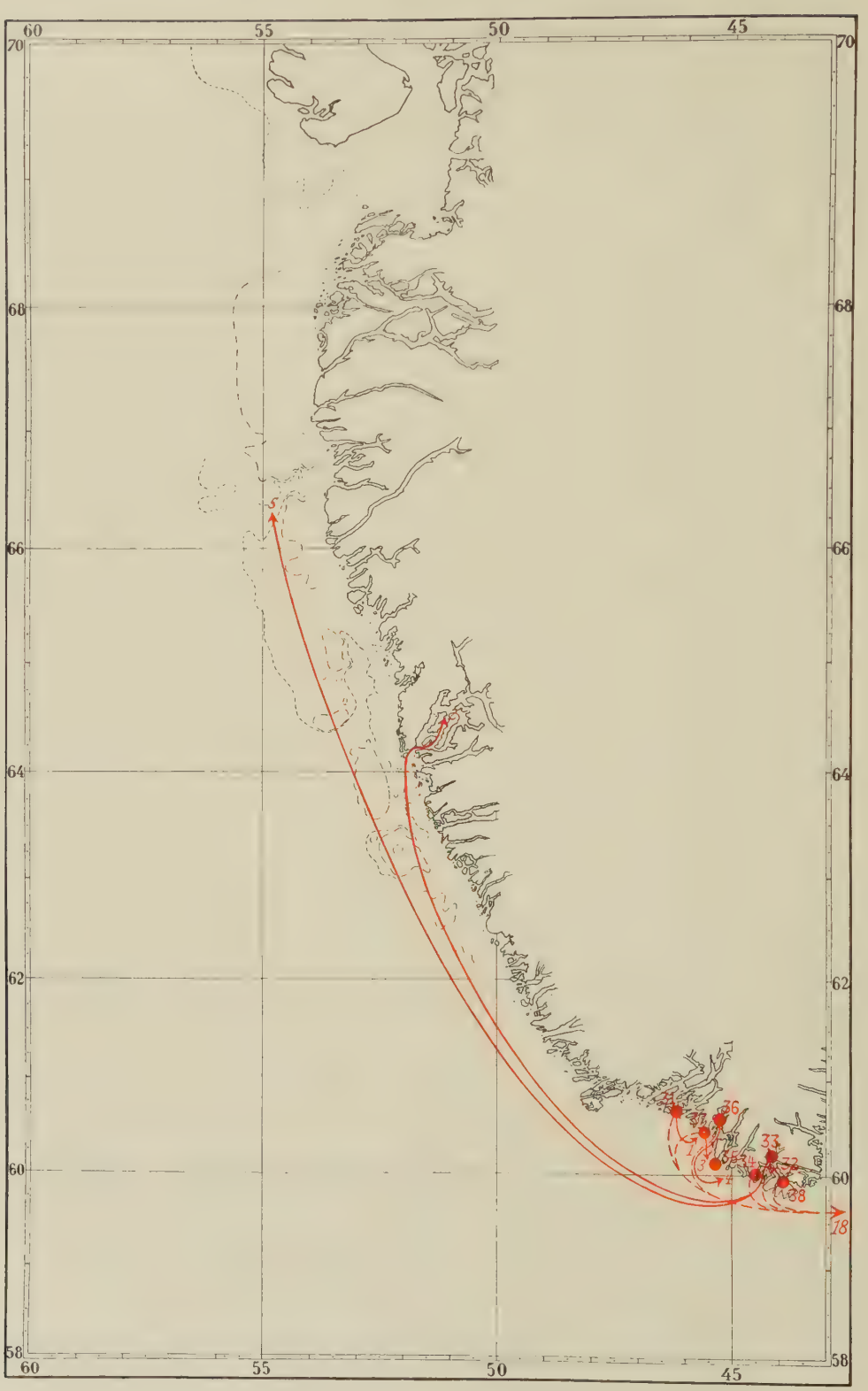

Fig. 15. Migrations of Cod marked **1929.**

Fig. 16. Emigrants to Iceland from marking experiment **1929**. ○ specimens recaught 1 year, ● 2 years, + 3 years, ▲ 4 years and △ 5 years after marking.

Marking experiments 1929.

Exp. No. Month	Recaptures from Greenland (see Fig. 15). No./Rec.	1929	1930	1931	1932	1933	1934
31. Aug.	119/1	7673[1]	—	—	—	—	—
32. Sept.	5/0	—	—	—	—	—	—
33. Sept.	54/2	—	7802[2]	—	—	—	7799[5]
34. Sept.	10/0	—	—	—	—	—	—
35. Sept.	62/4	—	7893*	7869*	7875*	—	—
			7897*				
36. Oct.	44/2	—	—	7925[4]	7938*	—	—
37. Oct.	131/7	8045*	7982[3]	—	7974*	—	—
		8069*	..	..	7978*		
		8075*	..	..	8057*		
38. Oct.	75/0	—	—	—	—	—	—
Total	500/16	4	4	2	5	—	1

Exp. No. Month	Recaptures from Iceland (see Fig. 16). No./Rec.	1929	1930	1931	1932	1933	1934
31. Aug.	119/2	—	7743	7666	—	—	—
32. Sept.	5/0	—	—	—	—	—	—
33. Sept.	54/1	—	—	—	—	7794	—
34. Sept.	10/1	—	—	—	7829	—	—
35. Sept.	62/0	—	—	—	—	—	—
36. Oct.	44/4	—	7906	7903	7901	—	—
					7923		
37. Oct.	131/7	—	7994	7996	—	—	8014
			7997	8005			
			8060	8058			
38. Oct.	75/3	—	—	8090	—	8139	—
				8115			
Total	500/18	—	5	7	3	2	1

Table 15. Direction of migrations 1929.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Julianehaab District	500	11	2	3	18

The Chart Fig. 16 shows that the Cod which travelled to Iceland were mainly retaken on the north-west coast and western part of the north coast, as also on the south-west coast. Table 16 gives the details of the recaptures. The first Cod of the 1929 experiment to appear at Iceland were retaken in the following year (earliest 15. May 1930); these were caught on the north-west banks of Iceland and were the first-comers of the great emigration to Iceland in the years 1930—34. In 1931 the recaptures appeared both north-west and south-west. Only one has reached the cold waters of East Iceland after the end of the spawning period (arbitrarily placed at 1st of June).

Table 16. Number of recaptures on the different coasts of Iceland of Cod marked in 1929 at West Greenland.

	1930		1931		1932		1933		1934		Total		Grand
Areas (Fig. 35, p. 70)	$^1/_{1-31/5}$	$^1/_{6-31/12}$	$^1/_{1-31/5}$	$^1/_{6-31/12}$	$^1/_{1-31/5}$	$^1/_{6-31/12}$	$^1/_{1-31/5}$	$^1/_{6-31/12}$	$^1/_{1-31/5}$	$^1/_{6-31/12}$	$^1/_{1-31/5}$	$^1/_{6-31/12}$	Total
1. N. (western) ..	1	1	2	—	—	—	1	—	—	—	4	1	5
2. N.W.....	2	1	—	2	—	—	1	—	1	—	4	3	7
3. W.....	—	—	1	—	—	1	—	—	—	—	1	1	2
4. S.....	—	—	2	—	1	—	—	—	—	—	3	—	3
5. S.E.....	—	—	—	—	—	—	—	—	—	—	—	—	—
6. E.....	—	—	—	—	—	1	—	—	—	—	—	1	1
7. N. (eastern) ..	—	—	—	—	—	—	—	—	—	—	—	—	—
	3	2	5	2	1	2	2	—	1	—	12	6	18
Total...	5		7		3		2		1		18		18

The approximate distances from the place of liberation to place of recapture are given in the following Table for the recaptures at Iceland.

Table 17. Minimum distance travelled by Cod emigrants to Iceland.

Miles	700-800	800-900	1000-1100
No. of specimens.....	14	3	1

By far the great majority, 14, have travelled between 700 and 800 miles, 3 have gone between 800 and 900 miles and only 1 has covered a distance of more than 1000 miles. The explanation of the difference is naturally, that the Cod first make for the spawning grounds at Iceland, thus to the west side of the island, and scatter later in the year, one even reaching as far as East Iceland.

Within the Greenland area two specimens have travelled very far northwards, one into the Godthaab Fjord and one to the Great Hellefisk Bank. Three have wandered quite a short distance to the south and may be considered, like the remaining 11 specimens, to have been retaken at the place of marking.

As the measurement curves of Cod belonging to the two year-classes which are the main constituents of the stock fished in 1929, are widely separated from each other, almost all the

Cod with lengths between 45 and 61 cm. may be referred to the 1924 year-class and those between 61 and 92 cm. to the 1922 year-class. It is thus possible with a considerable amount of certainty to determine from the total length alone, to which year-class each of the recaptured fish belongs (see Jensen & Hansen 1930, p. 36, Fig. 8 and 1931, p. 30, Fig. 8).

On this basis we have indicated in the Table below, how many Cod of the 1924, 1922 and still older year-classes may be considered to have been recaptured in the different years, both at Greenland and Iceland (age determined from length of fish). The recaptures at Iceland are given last (e. g. 2+5 means 2 recaught at Greenland and 5 at Iceland).

Table 18. Age of Cod marked within the West Greenland area and recaught there or at Iceland (1929 experiment).

Year-class	Age-group when marked	1[1]) 1929	2 1930	3 1931	4 1932	5 1933	6 1934	Total recaught	%
1924	V	0+0	0+0	2+1	1+1	0+1	0+0	3+3 = 6	17.6
1922	VII.....	1+0	2+5	0+6	4+2	0+1	1+1	8+15 = 23	67.6
Older than 1922,	VII+.....	3+0	2+0	0+0	0+0	0+0	0+0	5+0 = 5	14.7

As will be seen, most of the recaptured Cod, 23 or 68 %, are of the 1922 year-class, which is natural enough as it composed about 70 % of the catches analysed in 1929 from the Julianehaab District, whilst the 1924 year-class amounted to about 18 %, thus almost the same proportions as we meet with in the recaptures, according to the above scheme (cf. Jensen & Hansen 1930, pp. 30—31, Fig. 4 and 1931, p. 25, Fig. 4).

Of the 1924 year-class just as many were retaken at Iceland as at Greenland; of those taken again at Greenland 2 have remained stationary, whilst one was retaken about 35 miles south from the place of liberation. The first emigrant to Iceland was recaught in 1931, thus in its seventh year, the next two in 1932 and 1933. The recapture of individuals of the 1922 year-class is almost twice as great at Iceland as at Greenland; thus, an extensive emigration of this year-class to Iceland has occurred at this time. In 1930 already we have 5 recaptures at Iceland of this year-class and in the following years 6, 2, 1 and 1. Near the place of liberation 5 individuals of this year-class were recaptured. Of the 5 which have travelled somewhat farther in Greenland waters 1 was retaken 20 miles to the south, another 10—20 miles to the north, whilst a third was retaken on the banks about 500 miles from the place of liberation.

Of the year-classes older than the 1922 class which are represented in the recaptures, the 1920, 1919 and 1917 year-classes are specially in evidence. These were found represented in the catches at Greenland in the investigations of earlier years. From Table 18 it will be seen that a relatively high percentage of these old fish has been recaptured, in proportion to their representation in the stock; 3 were retaken near the place of marking, 1 has travelled 25 miles southwards, another about 300 miles to the north. Not one has been retaken at Iceland, indicating probably that the majority have reached an age at which only restricted wanderings are undertaken.

2. Time in the sea and rate of migration.

Of the 34 recaptures from this marking experiment 4 were made in the year of marking, 3 very close to the place of liberation. The others are distributed over the following years as shown in the accompanying Table. The latest recaptures (2) are from 1934 and one of these was taken at Iceland.

[1]) Year of marking.

Table 19. Number of Cod recaptured during the different years after marking (1929).

No. marked		1 1929	2 1930	3 1931	4 1932	5 1933	6 1934	Total
500	No. recapt.	4+0	4+5	2+7	5+3	0+2	1+1	16+18

About 10 individuals were retaken near the place of marking, 3 in the first year, as already mentioned, 2 in the next, 1 in the third and 4 in the fourth year.

With regard to the individuals of the 1924 year-class recaptured at Greenland, 2 were taken near the place of marking, one after 2 years, the other after 3 years; the third was retaken about 35 miles south of the place of marking 2 years thereafter. Of the 5 individuals of the 1922 year-class recaught near the place of liberation, two were taken 1 year and three 3 years after marking. Other five individuals of the same year-class have travelled somewhat farther; one was retaken in the year of marking about 20 miles to the south 2 months after liberation; a second in 1932, thus after 3 years in the sea, about 10—20 miles to the north, whilst a third was retaken in 1934 out on the banks. The last has covered a distance of about 500 miles in about 58 months, the time it has been in the sea after marking. Of the year-classes older than the 1922 class three individuals were retaken in the year of marking near the place of liberation; one had travelled about 25 miles to the south, another about 300 miles to the north; the latter has covered about 300 miles in the course of $8^1/_2$ months, thus about 1 mile per day at the least.

As we cannot tell when the Cod, retaken at Iceland in 1931 and following years, began their emigration from Greenland, greatest interest is attached to the 5 individuals recaptured in 1930 already (see Table 18, p. 35). Considering the distance these 5 have travelled and the time that has intervened between liberation and recapture, we can form some estimate of the rate of migration. Table 20 shows how many miles per day the few recaptured fish, taken in the course of the first year, have travelled.

Table 20. Rate of migration 1929—30 (recaptures at Iceland).

Miles per day	2.5—3.0	3.0—3.4	Total
No. of Cod	2	3	5

The average minimum rate of travel lies between 2.8 and 3.4 miles per day, thus about 3 miles per day. It is obvious that these estimates can only give the minimum rate; it is hardly probable that the Cod have at once set out on their travels after being marked or that they were caught immediately on their arrival at Iceland. Again, we cannot imagine that their route has followed the shortest line between the place of marking and place of recapture, which we must use in estimating the distance travelled.

VII. Experiments 1930.

In 1930 altogether 1454 Cod were marked and liberated from the M/B "Misilîssok". All were marked in the coastal waters and fjords, from Nanortalik in the south to Godthaab in the north. No Cod were marked this year on the banks. Details are as follows.

Sukkertoppen, 1, November	4	spec.
Godthaab District, 15—27, October	297	—
Frederikshaab District, 3—27, September	353	—
Julianehaab District, 25, June—26, August	800	—

The measurements of the Cod marked are displayed in the accompanying curves for each district (Fig. 17). For all localities the lengths lie between 50 and 95 cm., but the size-distribution is very different in the different districts. In the Julianehaab District far more smaller Cod have been marked on the whole than in the other districts; the apex of the curve is at 60—64 cm. At Frederikshaab the proportions of larger and smaller are more even, though the latter are in the majority with the apex at 60—64 cm. At Godthaab we have a different condition, the apex of the curve of measurements being at 85—89 cm.

Fig. 17. Size of Cod marked 1930.

According to the age analyses made on material from the same districts in 1930 (see HANSEN 1934 b, pp. 4—5) it is still the two year-classes 1924 and 1922 which contribute mainly to the stock of Cod at Greenland. In the Frederikshaab and Godthaab Districts both are present in the catches in almost equal proportions. In the Julianehaab District, on the other hand, the age analyses show that the 1922 year-class still dominates with 55 % against 30 % for the 1924 class. The curve for the marked fish of Julianehaab District (Fig. 17) appears to have one almost distinct maximum, but owing to the considerably slower growth of the Cod at this part of West Greenland (see JENSEN & HANSEN 1930, p. 16 et seq.; 1931 p. 12 et seq.), the curves for the two year-classes (1922 and 1924) overlap one another. The Julianehaab curve thus comes to have quite a different appearance from the curves for more northerly places. Further, a large proportion of the Julianehaab fish were marked in 1930 in the months of June—July, but the Godthaab and Frederikshaab fish in September—October; this again makes the size of the marked fish of the respective year-classes at Julianehaab lower than at the northern places.

The 1926 year-class which later becomes so great, has practically no importance in this year; it is strongest at Godthaab but with only 7 % (see HANSEN 1934, pp. 4—5, Figs. 2 a & b). It thus appears that both mature and immature Cod are represented among the marked fish, for the 1924 year-class at 6 years old has not yet reached maturity, whereas some of the 1922 year-class may be considered mature.

This year unlike the foregoing it is not possible to tell approximately the age of the marked Cod from the length alone, as the length curves for the two year-classes now overlap a good deal, where they were quite distinct in 1929.

Of the 1454 Cod marked altogether 107 have been recaptured, a percentage of 7.4; 32 were retaken at Greenland, 75 at Iceland or more than twice as many at the latter (no information is available for 1 recapture). Taken on the whole we have more recaptures from Iceland in this year's experiment than in any of the other years. See App. A, p. 100.

MIGRATIONS & AGE AND SIZE OF THE MIGRATING COD

1. Direction and extent of the migrations.

The Charts Fig. 18 and Fig. 19 show the migrations of the Cod marked in 1930. We see that 75 specimens from almost all the localities where Cod were marked this year, have migrated to Iceland.

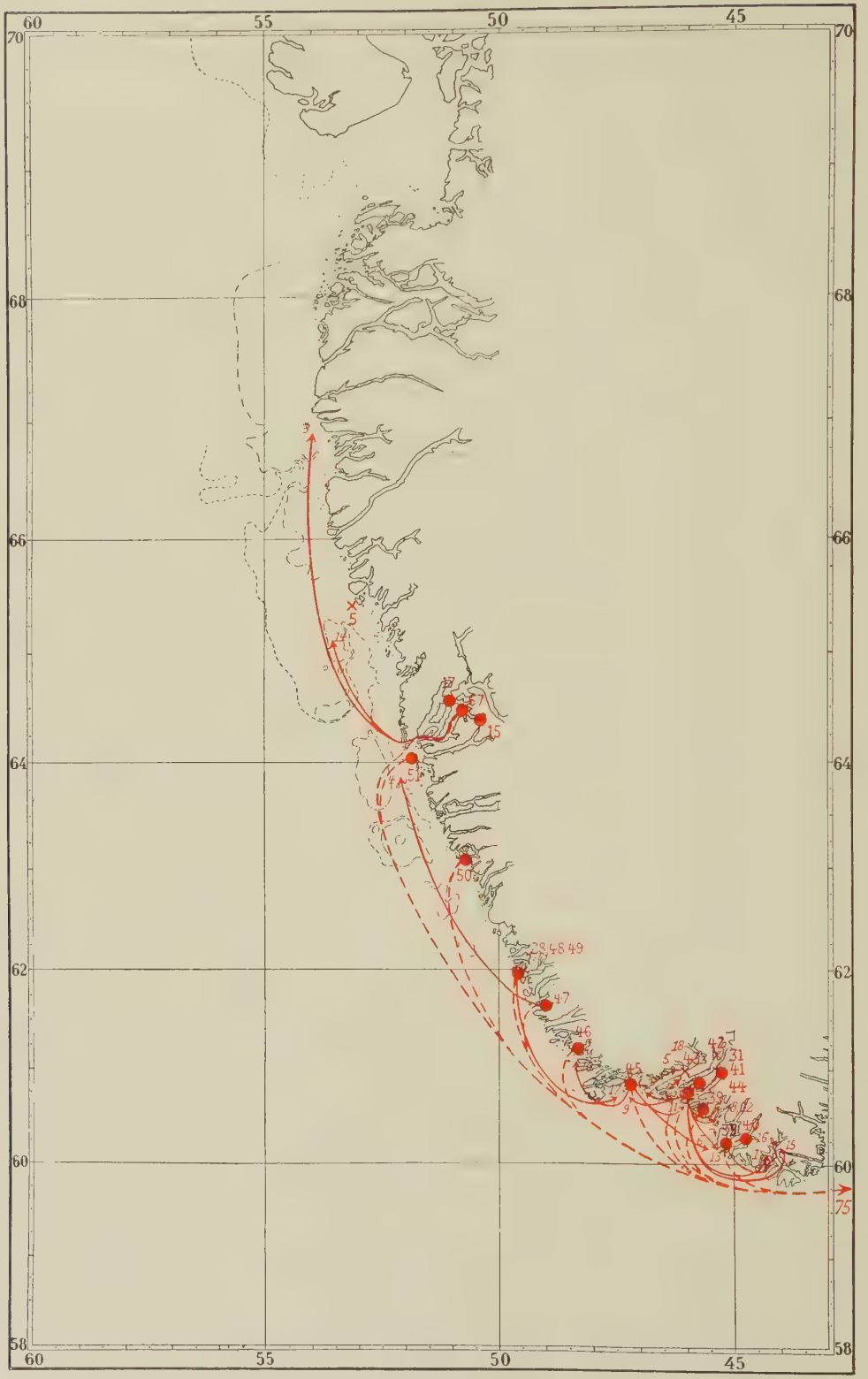

Fig. 18. Migrations of Cod marked **1930.**

Marking experiments 1930.

Recaptures from Greenland (see Fig. 18).

Exp.No. Month	No./Rec.	1930	1931	1932	1933	1934
5.						
Nov.	4/0	—	—	—	—	—
17.						
Oct.	11/2	—	—	—	—	9356*
						9359*
67.						
Oct.	86/2	—	9377[3]	—	9411[14]	—
15.						
Oct.	3/1	—	9353*	—	—	—
51.						
Oct.	100/0	—	—	—	—	—
50.						
Oct.	97/1	—	9320*	—	—	—
28, 48, 49.						
Sept.	153/1	—	—	—	—	9180[17]
47.						
Sept.	100/3	9078*	9013[4]	—	—	—†)
46.						
Sept.	100/0	—	—	—	—	—

Exp.No. Month	No./Rec.	1930	1931	1932	1933	1934
45.						
Aug.	100/4	—	8812[5]	8871[10]	—	—
			8879[6]	8888[11]		
31,44.						
July-Aug.	447/14	8353[1]	8613[7]	8549[12]	8335[15]	8557[18]
		8375[2]	8669[8]	8592*		
		8432*	8765[9]	8660*		
		8795*	..	8746[13]		
				7606*		
43.						
Aug.	41/0	—	—			
42.						
Aug.	14/0	—	—	—	—	—
41.						
July	18/0	—	—	—	—	—
39.						
June	14/1	8157*	—	—	—	—
35 & 40.						
June-July	166/4	—	8245*	—	8266*	—
			8270*	—	8306[16]	
Total	800/32	6	11	7	4	4

Table 21. Direction of migrations 1930.

District	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland	Locality unknown
Sukkertoppen	4	0	0	0	0	0
Godthaab	297	4	2	0	11	0
Frederikshaab	353	1	1	1	15	1
Julianehaab	800	9	5	9	49	0
Total	1454	14	8	10	75	1

The Chart Fig. 19 shows that the emigrants to Iceland were mainly retaken in the areas N.W., W. and S. Iceland; Table 22 shows the number of recaptures on the different coasts for each year after the year of marking (see also Appendix A, p. 100). After spawning the Cod seem to scatter and travel towards the colder parts of the island (eastern parts), but in this year and possibly in all years of the present period the majority do not seem to have made for East Iceland and its banks, where the fishery for spent large Cod has been poor for some years, but have probably moved towards the west (banks opposite East Greenland, East Greenland and West Greenland).

†) one: No. 9023 — no particulars available.

* Stationary.

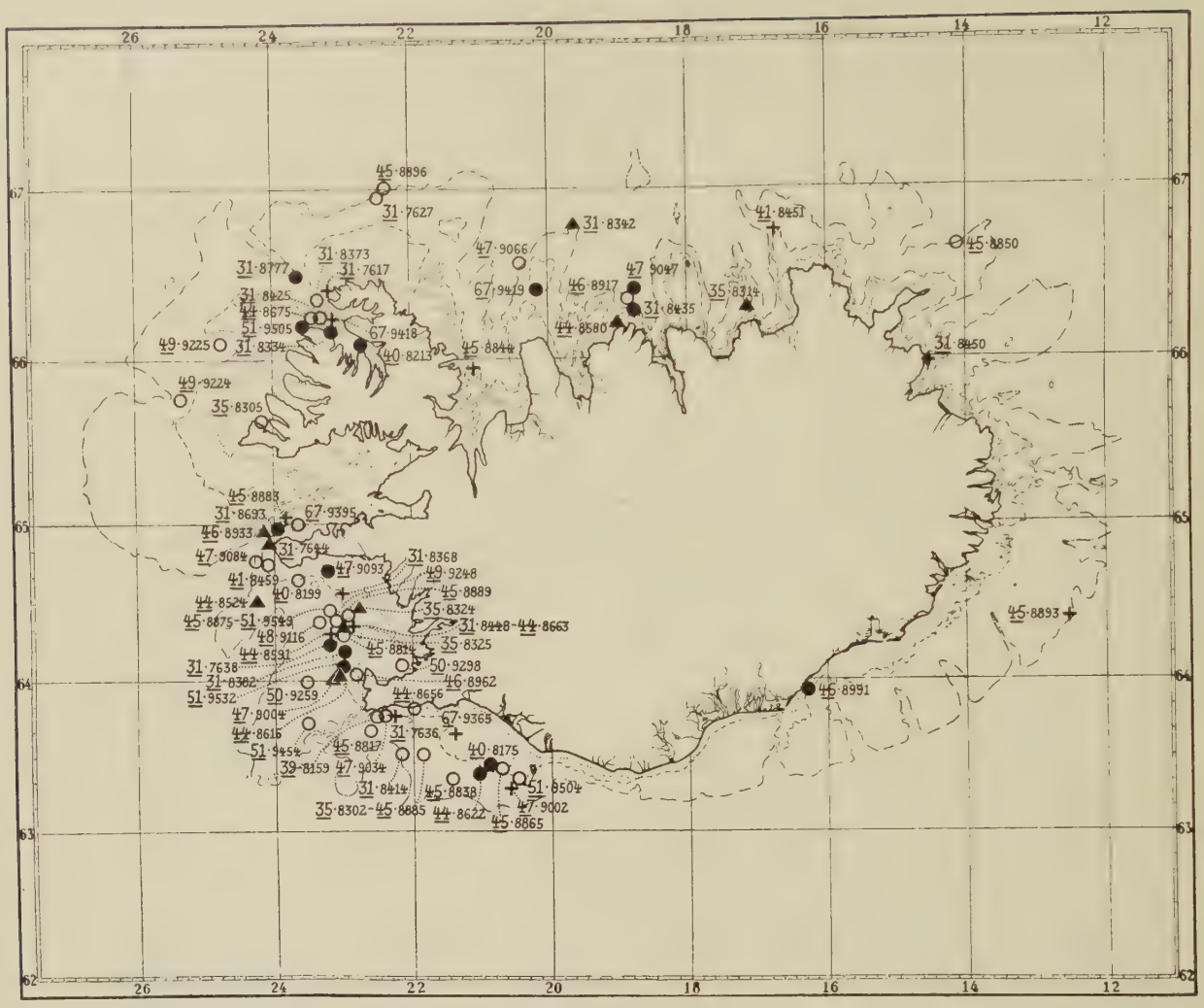

Fig. 19. Emigrants to Iceland from marking experiment **1930**. ○ specimens recaught 1 year, ● 2 years, + 3 years and ▲ 4 years after marking.

Table 22. Number of recaptures on the different coasts of Iceland of Cod marked in 1930 at West Greenland.

Areas (Chart Fig. 35)	1930		1931		1932		1933		1934		Total		Grand Total
	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	
1. N. (western)	—	—	3	1	3	—	1	—	—	2	7	3	10
2. N.W.	—	—	5	1	3	1	1	(1[1]) —	—	—	9(1[1])	2	12
3. W.	—	—	12	2	5	—	5	—	7	—	29	2	31
4. S.	—	—	8	2	2	—	2	(1[1]) —	—	—	12(1[1])	2	15
5. S.E.	—	—	—	—	1	—	—	—	—	—	1	—	1
6. E.	—	—	—	—	—	—	1	1	—	—	1	1	2
7. N. (eastern)	—	—	—	1	—	—	—	1	—	1	—	3	3
Loc. unknown					1						1		1
	—	—	28	7	14	1	1	10 (2[1])	2	7	3	59(2[1])	1 13	75
Total	—		35		16		14		10		75		

[1]) Date of recapture unknown.

Marking experiments 1930

Recaptures from Iceland (see Fig. 19).

Exp.No. Month	No./Rec.	1930	1931	1932	1933	1934
5.						
Nov.	4/0	—	—	—	—	—
17.						
Oct.	11/0	—	—	—	—	—
67.						
Oct.	86/4	—	9395	9419	9365	—
					9418	
15.						
Oct.	3/0	—	—	—	—	—
51.						
Oct.	100/5	—	9454	9505	—	—
			9504	9532		
			9549			
50.						
Oct.	97/2	—	9259	—	—	—
			9298			
28, 48, 49.						
Sept.	153/4	—	9116	—	—	—
			9224			
			9225			
			9248			
47.						
Sept.	100/7	—	9034	9047	9002	9004
			9066	9093		
			9084			
46.						
Sept.	100/4	—	8917	8991	—	8933
			8962			
45.						
Aug.	100/12	—	8814	—	8844	—
			8817		8883	
			8838		8893	
			8850			
			8865			
			8875			
			8885			
			8889			
			8896			
31 & 44.						
July-Aug.	447/26	—	7627	7638	7617	7644
			8373	8334	8368	8524
			8414	8382	8448	8580
			8425	8435	8450	8616
			8656	8622	8591	8342
			8675	8693	8663	
				8745†)	7636	
				8777		
43.						
Aug.	41/0	—	—	—	—	—
42.						
Aug.	14/0	—	—	—	—	—
41.						
July	18/2	—	8459	—	8451	—
39.						
June	14/1	—	8159	—	—	—
35 & 40.						
June-July	166/8	—	8199	8175	—	8314
			8302	8213		8324
			8305			8325
Total	1454/75	—	35	16	14	10

The lengths of the Cod which travelled to Iceland in this experiment, lay chiefly between 75 and 85 cm.; no emigrants were over 100 cm. The approximate distances of the recaptures from the places of liberation are indicated in the following Table.

Table 23. Minimum distance travelled by Cod emigrants to Iceland.

Miles	600—700	700—800	800—900	900—1000	1000—1200
No. of specimens	8	29	20	11	6

Remarkably few recaptures were made at Greenland this year. Apart from a number of Cod, which were marked in the Julianehaab District and have made short migrations of little interest within that district, we have 3 long migrations towards the north. One Cod has travelled from Neria to the Godthaab area, whilst the other two have gone from Umanak in Godthaab Fjord to the Little Hellefisk Bank and Kagssit Islands Bank at Holstensborg. These three migrants, which have gone from the fjord areas to the coast or banks, have travelled respectively 120, 115 and 250 miles. Their lengths were 74 cm., 60 cm. and 111 cm. on marking and 78 cm., 78.5 cm. and ? cm. on recapture.

†) Locality unknown.

2. Time in the sea and rate of migration.

Of the 32 recaptures at Greenland no fewer than 15 were made in the immediate neighbourhood of the marking place, 4 in the same year, 5 the year after, 3 in 1932, 1 in 1933 and 2 in 1934, the last after a period of 4 years. The short wanderings in the Julianehaab District, all with one exception within the boundaries of the district, have no special interest; recaptures have been made in the year of marking and the ensuing 3 years. Of the long northward migrations already mentioned, 2 were accomplished within a fairly short period and are thus interesting. The one specimen was marked at Neria in the Frederikshaab District and recaptured about 12 months later at Kangek near Godthaab, a distance of 160 miles. The second was marked at Umanak in Godthaab Fjord and 9 months later was recaptured 250 miles to the north, off Holstensborg. In the latter case the rate of travel has been more than 27.8 miles in the month or about 1 mile per day. With regard to the third long migration northward, namely from Umanak in Godthaab Fjord to the Little Hellefisk Bank, about 115 miles, the recapture was made in 1933, the third year after marking; hence nothing can be concluded about the rate of travel.

Table 24. Number of Cod recaptured during the different years after marking (1930).

No. marked		1 1930	2 1931	3 1932	4 1933	5 1934	Total
1454	No. recaptured.....	6+0	11+35	7+16	4+14	4+10	32+75

With regard to the size of the fish which have kept within Greenland waters during their migrations, the individual that travelled farthest north was 111 cm. long and thus belonged to one of the oldest year-classes, possibly 1917. The other two with long northward migrations were 60 and 74 cm. on liberation and both measured about 78 cm. on recapture. These have probably belonged to the 1924 year-class.

Of the 75 Cod that migrated to Iceland 35 were retaken in the year after liberation, 16 in 1932, 14 in 1933 and 10 in 1934. As we do not know when the individuals retaken in 1932 and following years made the passage to Iceland, we must leave these out of consideration in estimating the rate of travel and keep exclusively to the 35 recaptured in the year after marking. The estimated rates are given in the Table below.

Table 25. Rate of migration 1930—31 (recaptures at Iceland).

Miles per day	2.0—2.5	2.5—3.0	3.0—3.5	3.5—4.0	4.0—4.5	4.5—5.0	5.0—5.5	Total
No. of Cod.....	7	9	9	4	1	2	3	35

It will be seen that more than half the individuals have travelled at least between 2.5 and 3.5 miles per day. Special interest is attached to the 3 specimens that show an average minimum speed of 5.0—5.5 miles daily. They were all 3 marked in the end of October 1930 in the Godthaab District; so far as we know, this would be rather near the time when the emigration begins. One was marked at Umanak right inside the Godthaab Fjord on 18, October and was recaptured on 28, April at Olafsvik, N. Iceland. It measured 86 cm. on liberation and probably belonged to the 1922 year-class. The other two were marked off Godthaab at Kakaliak; liberated 21—27, October they were recaptured at Iceland in the middle of April and beginning of May respectively. As they were of considerable size, 95 and 91 cm., they also belonged probably to the 1922 year-class.

VIII. Experiments 1931.

In 1931 altogether 1652 Cod were marked, in the fjords and coastal waters as well as out on the banks, from Egedesminde District in the north to Julianehaab District in the south. The marking on the banks was carried out mainly from the inspection-vessel "Hvidbjørnen", in the fjords and coastal waters from the motor-boat "Umarissok". Details are given below.

Egedesminde District, 29, July—2, August	25	spec.
Great Hellefisk Bank, 3, July—3, August	145	—
Little Hellefisk Bank, 26, June—16, August	465	—
Holstensborg District, 19, July—24, July	159	—
Sukkertoppen District, 5, August—13, August	358	—
Fylla Bank, 5, July—15, August	86	—
Godthaab District, 30, August—12, September	229	—
Dana Bank, 17, August	1	
Julianehaab District, 2, October—12, October	184	—

The markings this year were fairly evenly distributed between the bank, fjord and coastal areas. See App. A, p. 104.

The majority of the 126 Cod marked 22-24/VII at Maligiak inside the Ikertokfjord (Holstensborg District; see Appendix A, p. 106) were large and very thin fish which had apparently just come into the fjord from the banks outside. They were pursuing the Capelan (*Mallotus*) which were still spawning, though only to a small extent. The 241 Cod marked 15/VIII off Kangamiut on the Little Hellefisk Bank (see Appendix A, p. 106) were swimming in the surface waters after Sand-eels (*Ammodytes*). The Cod were extremely abundant in this locality, all on the surface and with their stomachs full of large Sand-eels, shoals of which were also observed. They bit eagerly at the shining tin-bait, so that it was possible to catch as many as were wanted. The crew of a motor-boat sailing that day from Sukkertoppen to Kangamiut reported, that they had observed large shoals of Cod at the surface along the whole route. On the following day, when 150 individuals were marked, the weather had turned stormy with a wind from the south-west. The Cod were then deeper in the water and had their stomachs filled with prawns; none were observed on the surface.

The measurement curves for the Cod marked in the different areas are given in Fig. 20. It will be seen, that the smallest Cod, of between 55 and 75 cm. in length, were marked in the more southerly coastal and fjord areas. The smallest number of large fish were taken at Julianehaab, but considerably more at Sukkertoppen. At Holstensborg the proportions of large and small fish were fairly even; on the banks the large fish were in absolute majority, most being from 80 to 100 cm. in length. It may be considered that the immature Cod were in the majority in the Julianehaab and Godthaab Districts. At Sukkertoppen probably

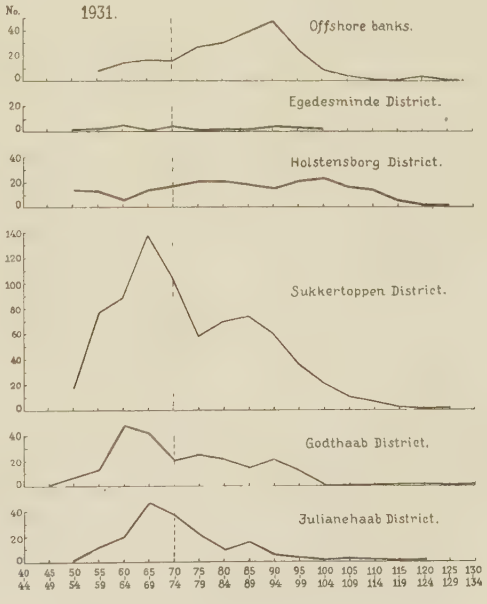
No.
1931.
Offshore banks.
Egedesminde District.
Holstensborg District.
Sukkertoppen District.
Godthaab District.
Julianehaab District.
40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130
44 49 54 59 64 69 74 79 84 89 94 99 104 109 114 119 124 129 134

Fig. 20. Size of Cod marked 1931.

there were almost as many immature as mature, whilst most of the Cod marked at Holstensborg and on the banks were mature fish.

According to the age analyses of catches from the various districts this year (see HANSEN 1934b, pp. 4—5, Figs. 2a & b) three year-classes were of chief importance, namely the 1926, 1924 and 1922 classes; in the Holstensborg District and at a few places on the banks also the 1917-class. In the Julianehaab District the 1924-class has certainly made up the greater number of the Cod marked; it amounted to about 62 % in the catches, whilst the 1922 year-class showed about 25 % and the 1926-class about 9 %. At Godthaab and especially at Sukkertoppen the three year-classes are almost equally represented. In the fjord at Holstensborg these three classes are likewise almost of the same dimensions, but are exceeded here by the 1917 year-class. The last-mentioned dominates on the Great Hellefisk Bank (ca. 66 %), then comes the 1922-class, whilst the others are quite unimportant. The many Cod (391 specimens) marked in August off Kangamiut on the Little Hellefisk Bank, also those marked in June in the middle of this Bank, seem to indicate, according to age analyses of catches from these localities, that the 1917 year-class was inconsiderable in amount there, whilst the three other year-classes were more abundant, with the 1922 year-class possibly the most numerous.

Whilst the 1917 and 1922 year-classes have mostly been mature in 1931, the individuals of the 1924-class have certainly for the most part not become mature before 1932 and most of the 1926 year-class not before 1934 and following year.

Of the 1652 Cod marked in this year altogether 97 have been recaptured, which gives 5.9 %. In contrast to the experiments in the previous year we have more recaptures from Greenland than from Iceland, 58 from the former, 39 from the latter.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Chart Fig. 21, p. 46 shows the migrations undertaken by the Cod marked in 1931 at West Greenland.

Table 26. Direction of migrations 1931.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Egedesminde	25	0	0	0	1
Holstensborg	159	6	2	4	1
Great Hellefisk Bank	145	4	0	4	3
Little Hellefisk Bank	465	2	10	4	14
Sukkertoppen	358	6	3	4	9
Godthaab	229	3	1	1	5
Fylla Bank	86	0	0	0	0
Dana Bank	1	0	0	0	0
Julianehaab	184	3	0	1	6
Total	1652	24	16	18	39

As noted above, only 39 individuals of this year's marking experiment have migrated to Iceland. Most of these were retaken at south-west Iceland, fewer on the north coast and only a single specimen on the east coast (see Chart Fig. 22). Most of the recaptures at Iceland were made as usual in the spring months before June 1st. Details with regard to the recaptures at Iceland from this year's marking experiment are noted in the accompanying Table.

Table 27. Number of recaptures on the different coasts of Iceland of Cod marked in 1931 at West Greenland.

Areas (Chart Fig. 35)	1932		1933		1934		Total		Grand Total
	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	
1. N. (western)	1	2	2	1	—	1	3	4	7
2. N.W.	2	—	—	—	—	—	2	—	2
3. W.	4	1	11	—	2	—	17	1	18
4. S.	3	1	5	—	—	—	8	1	9
5. S.E.	1	—	—	—	—	—	1	—	1
6. E.	—	—	1	—	—	—	1	—	1
7. N. (eastern)	—	—	—	—	—	—		—	
Loc. and date unknown			1				1		1
	11	4	19	1 1	2	1	32	1 6	39
Total	15		21		3		39		39

It will be seen that more than half the recaptures are in the spring months at West and South Iceland, where we find the principal spawning places in Icelandic waters. The distance travelled during migration lies between at least 720 and 1530 miles.

Table 28. Minimum distance travelled by Cod emigrants to Iceland.

	Miles 700—800	800—900	900—1000	1000—1200	1200—1400	1400—1600	Total
No. of specimens	5	1	3	22	5	2	38

In this year's marking experiment a great many large Cod have travelled to Iceland. The initial and ultimate lengths for 7 of the largest were: 101—?, 95—?, 100—101, 100—?, 105—?, 96—100 and 100—?. From only one of these have we received otoliths for examination; its ultimate length was 100 cm. and it proved to belong to the 1922 year-class. The remainder probably belonged to this year-class also.

The two smallest which have undertaken the journey to Iceland had the following initial and ultimate lengths: 60—65 cm. and 65—?. The first was recaptured in 1933, the second in 1932; the latter on age analysis proved to belong to the 1926 year-class. Thus at an age of 6 years already it has undertaken the journey to Iceland; it was marked on the Little Hellefisk Bank off Kangamiut.

Of the 58 recaptures in the waters of Greenland from this year's marking altogether 24, thus about half, were taken within 20 miles of the place of liberation. As appears from the Chart, almost equally many of the marked Cod have travelled north as south. The former, however, have on the whole travelled greater distances than those which have gone southwards. The longest migration to the north has been made by a Cod which was marked at Umanak in Godthaab Fjord and recaptured on the north edge of the Great Hellefisk Bank about 300 miles to the north. It was a very large Cod of 130 cm. when liberated. Two marked at Sukkertoppen have made long journeys of 140 and 160 miles to the north; at the time of marking they measured 94 and 85 cm. (size on recapture unknown). Three Cod liberated on the Little Hellefisk Bank were recaptured 100, 102 and 130 miles north of the place of libera-

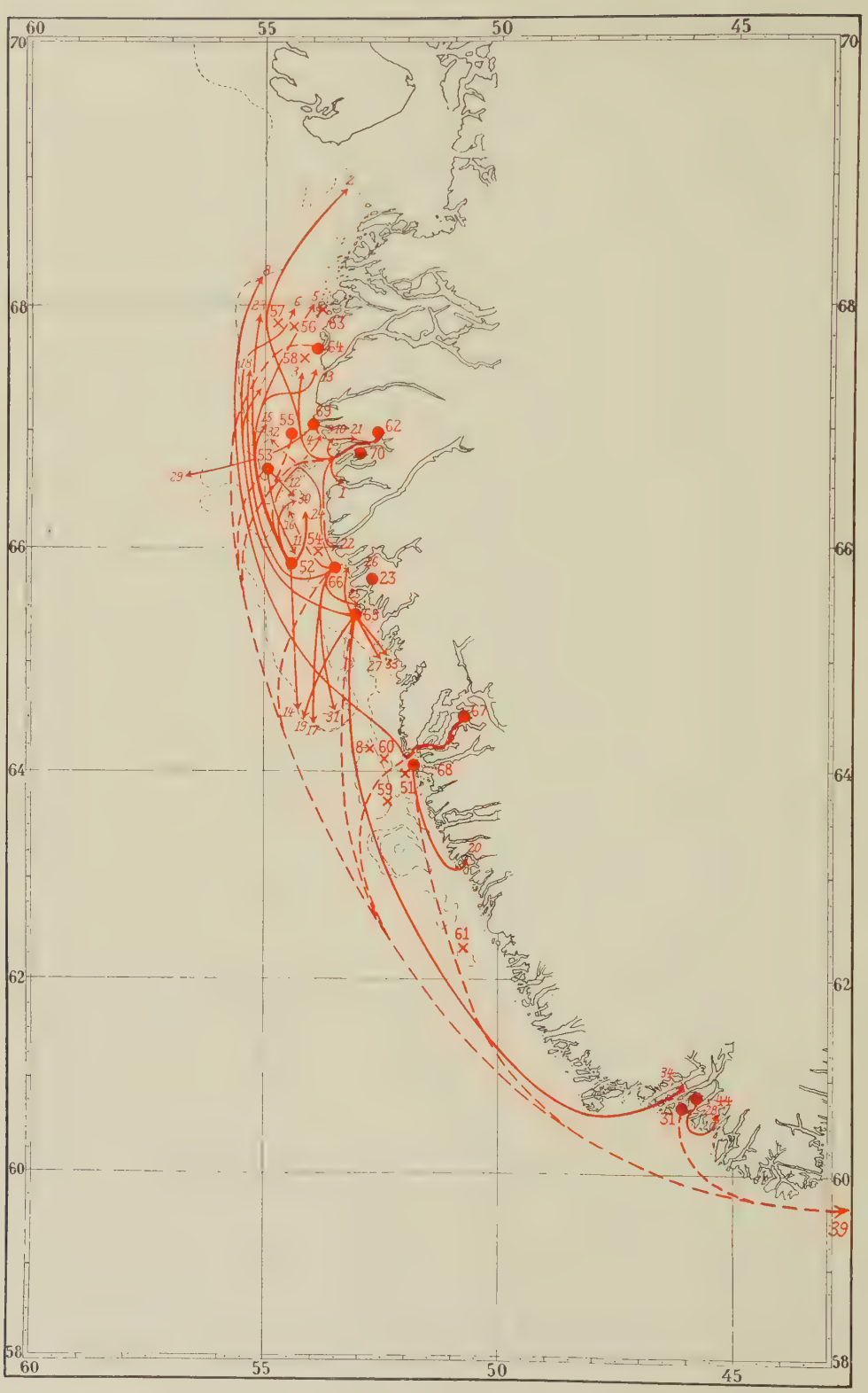

Fig. 21. Migrations of Cod marked **1931.**

Marking experiments 1931.

Recaptures from Greenland (see Fig. 21).

Exp.No. Month	No./Rec.	1931	1932	1933	1934
63.					
July	21/0	—	—	—	
56 & 57.					
Aug.	6/0	—	—	—	
64.					
Aug.	4/0	—	—	—	
58.					
Aug.	7/0	—		—	
55.					
July	18/0	—	—	—	
69.					
July	62/5	9575*	9566*	9616†)[21]	9585[29]
		9577*			
62.					
July	126/11	11711[1]	11718[9]	11732[22]	—
		11724[2]	11719*	11749*	
		11785*	11802[10]		
		11789[3]	11804*		
			11818*		
70.					
July	33/1	—		9619*	—
53.					
July	52/3	—	10779[11]	—	
			10790[12]		
			10794*		
52.					
June	69/8	10726[4]	10722[13]	10720[23]	10732[30]
		10761[5]	10740[14]	10756[24]	
			10760[15]		
54.					
July	5/0	—	—		—

Exp.No. Month	No./Rec.	1931	1932	1933	1934
66.					
Aug.	391/8	—	12240[16]	12286*	12261[31]
			12374*	12339[25]	12456[32]
			12449[17]		
			12575[18]		
23.					
Aug.	48/3	—	12198*	12202*	12192*
65.					
Aug.	310/10	11914*	12148[19]	11874[26]	11883[33]
		11988[6]		12108[27]	12022[34]
		12018*			12117*
		12087[7]			
67.					
Sept.	47/3	12648[8]	12631*	12642*	—
8.					
July	15/0	—	—	—	—
51.					
Aug.	27/0	—	—	—	—
68.					
Sept.	155/2	—	12748*	—	—
			12792[20]		
60.					
Aug.	55/0	—	—	—	—
59.					
Aug.	16/0	—	—	—	—
61.					
Aug.	1/0	—	—	—	—
44.					
Oct.	79/2	12879*	—	12865[28]	—
31.					
Oct.	105/2	—	12934*	—	12973*
Total	1652/58	14	22	13	9

tion; they measured on liberation and recapture: 92—?, 68—72 and 102—? cm. One Cod marked in Ikertokfjord was retaken right up at Hunde Ejland, which so far is the only known recapture from North Greenland. It measured 106 cm. on liberation.

Most of the journeys to the south barely exceed 80 miles, but two go beyond this considerably. The one individual, marked at Sukkertoppen, was recaptured in 1934 at Narssak in the Julianehaab District, about 340 miles south of the place of marking; initial and ultimate lengths 72 and 80 cm. The other, a Cod of 110 cm. on liberation, was marked in Ikertokfjord and recaptured in 1933 at Kangamiut, about 100 miles south of the place of liberation. Three have travelled about 75—80 miles southwards from the Little Hellefisk Bank and Sukkertoppen down to the south edge of the Little Hellefisk Bank. One Cod, 68 cm. on liberation, has wandered from Godthaab to Fiskenæsset and has travelled about 70 miles.

†) Year of recapture unknown, probably 1933.

Fig. 22. Emigrants to Iceland from marking experiment **1931.** ○ specimens recaught 1 year, • 2 years and + 3 years after marking.

2. Time in the sea and rate of migration.

Of the 27 Cod recaptured near the place of marking 6 were taken in the year of marking, 12 in 1932, 6 in 1933 and 3 in 1934. The following summary gives the recaptures in the respective years (emigrants to Iceland last).

Table 29. Number of Cod recaptured during the different years after marking (1931).

No. marked		1 1931	2 1932	3 1933	4 1934	Total
1652	No. recaptured.....	14+0	22+15	13+21	9+3	58+39

It will be seen, that most of the recaptures were made in 1932 and 1933. As in all the other marking experiments recaptures at Iceland only appear in the year after marking. Most of the Iceland recaptures were made in 1933, when 21 were taken.

Marking experiments 1931.

Recaptures from Iceland (see Fig. 22).

Exp.No. Month	No./Rec.	1931	1932	1933	1934
63.					
July	21/0	—	—	—	—
56 & 57.					
Aug.	6/0	—	—	—	—
64.					
Aug.	4/1	—	—	11848	—
58.					
Aug.	7/0	—	—	—	—
55.					
July	18/1	—	—	10842	—
69.					
July	62/0	—	—	—	—
62.					
July	126/1	—	—	11717	—
70.					
July	33/0	—	—	—	—
53.					
July	52/2	—	10777	10789	—
52.					
June	69/0	—	—	—	—
54.					
July	5/0	—	—	—	—
66.					
Aug.	391/14	—	12226	12322	12330
			12246	12355	12370
			12248	12393	12444
			12365	12421	
			12381	12442	
			12473		

Exp.No. Month	No./Rec.	1931	1932	1933	1934
23.					
Aug.	48/0	—	—	—	—
65.					
Aug.	310/9	—	11866	11862	—
			11890	11889	
				11904	
				11949	
				11999 †)	
				12122	
				12155	
67.					
Sept.	47/2	—	12629	12667	—
8.					
July	15/0	—	—	—	—
51.					
Aug.	27/0	—	—	—	—
68.					
Sept.	155/3	—	12698	12683	—
			12706		
60.					
Aug.	55/0	—	—	—	—
59.					
Aug.	16/0	—	—	—	—
61.					
Aug.	1/0	—	—	—	—
44.					
Oct.	79/2	—	12848	12841	—
31.					
Oct.	105/4	—	12935	12951	—
			12959	12957	
Total	1652/39	—	15	21	3

With regard to the rate of travel during migration, only recaptures in the 1st and 2nd year are of interest, just as in the other experiments. Of the recaptures at Greenland only those of the first year come into consideration; here we have 8 cases altogether, 7 of them migrants to the north, 1 to the south. The following Table gives a summary of the rates of migration for the Cod recaptured at Greenland.

Table 30. Rate of migration 1931—32 (recaptures at Greenland).

Miles per day	2.5—3.0	3.0—3.5	3.5—4.0	4.0—4.5	4.5—5.0	5.0—5.5	Total
No. of specimens.....	2	1	2	2	0	1	8

The Table shows that one half lies between 3.5 and 4.5 miles per day; a single individual has travelled more quickly, 5.3 miles per day. Here as in the previous experiments the rate of migration means the minimum rate.

†) Locality unknown.

For the 15 recaptures at Iceland in 1932 we have the following minimum rates of migration.

Table 31. Rate of migration (recaptures at Iceland).

Miles per day	2.0—2.5	2.5—3.0	3.0—3.5	3.5—4.0	4.0—4.5	4.5—5.0	5.0—5.5	Total
No. of specimens	1	0	2	3	4	3	2	15

The most interesting cases are the two which have travelled between 5.0 and 5.5 miles per day. Both were marked in September, thus late in the fishing season; the one was liberated at Umanak in Godthaab Fjord 5-6 IX and recaptured 19 III 1932 at Akranes (Faxe Bay) after travelling at least about 990 miles, at a minimum speed of 5.1 miles per day. The second was marked off Godthaab 12 IX and recaptured at Westmanna Isls. 14 IV 1932 after travelling at least about 1040 miles at an average speed of 5.0 miles per day. The first was a medium-sized Cod of 76 cm. in length, the second a large fish of 100 cm.

IX. Experiments 1932.

In this year altogether 1104 Cod were marked from H.M.S. "Maagen", M S "Suðuroy" and M B "Umarissok". The Cod were marked in Julianehaab and Godthaab Districts, both fjord and coastal waters, and on the Great and Little Hellefisk Banks; details as follows.

Great Hellefisk Bank, 19. July—19. August	67	spec.
Little Hellefisk Bank, 15. July—21. August	529	—
Godthaab Fjord, 18. July	41	—
Julianehaab District, 17. May—22. September	467	—

The measurements of the Cod marked are given in the curves Fig. 23. It will be seen, that on the banks large fish mostly were marked, the majority being between 80–99 cm. In the Godthaab Fjord the proportion of larger and smaller is fairly equal, from 65–99 cm.; in the Julianehaab District the fish are mainly smaller and medium-sized, the sizes lying between 55 and 89 cm., most between 65 and 74 cm.

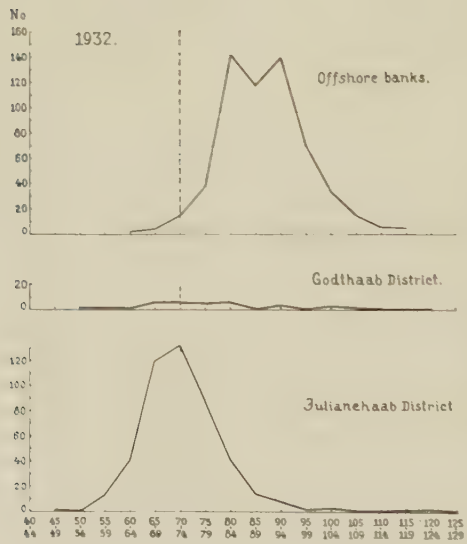

Fig. 23. Size of Cod marked 1932.

Age analyses of catches made in 1932 have shown, that four year-classes were specially abundant, namely 1917, 1922, 1924 and 1926. On the banks the greater part has certainly belonged to the older year-classes 1917 and 1922, thus being 15 and 10 years old. In the Godthaab Fjord the 1924-class, thus 8 years old, was most numerous (ca. 43 %), whilst the other three classes occur in almost the same proportions (10—20 % of the catch). In the Julianehaab District the 1924-class was by far the largest, with 63 %, then came the 1922-class with about 17 % and the 1926-class with 11 %; the 1917-class only amounted to 3.2 % of the catches in this District (see Hansen 1934, pp. 4—5, Figs. 2 a and 2 b).

Thus, on the banks and in Godthaab Fjord the Cod marked have certainly been mature for the most part (10—15 years old). In the Godthaab Fjord some Cod have probably been marked which have spawned in

here and not come from the coast or banks. The fish marked in the Julianehaab District consisted chiefly, as mentioned, of the 1924 year-class, which owing to the rate of growth in this district may be considered to become mature in 1933 and following years. The 1926 year-class, 6 years old in 1932, has not yet reached maturity in 1932—33.

Of the 1104 Cod marked this year 56 specimens in all or about 5 % have been recaptured; at Greenland 16 and at Iceland 40. Thus, $2^1/_2$ times as many were caught at Iceland as at Greenland. See App. A, p. 110.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Charts Figs. 24 and 25 display the wanderings of the Cod marked in 1932. It will be seen, that the 40 recaptures at Iceland have been emigrants from the Little Hellefisk Bank and Julianehaab District; from the former we have 11 emigrants, from the latter 29. Most emigrants have thus come from the Julianehaab District.

Table 32. Direction of migrations 1932.

	No. marked	Stationary	Migrated North	Migrated South	Migrated to Iceland
Great Hellefisk Bank	67	1	2[1])	2	0
Little Hellefisk Bank	529	1	4	1[2])	11
Godthaab District	41	0	0	1	0
Julianehaab District	467	3	1	0	29
Total...	1104	5	7	4	40

The recaptures at Iceland were distributed as follows.

Table 33. Number of recaptures on the different coasts of Iceland of Cod marked in 1932 at West Greenland.

	1932		1933		1934		Total		Grand
Areas (Chart Fig. 35, p. 70)	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	1/1-31/5	1/6-31/12	Total
1. N. (western)	—	—	2	2	—	2	2	4	6
2. N.W.	—	—	1	1	—	1	1	2	3
3. W.	—	—	11	—	6	1	17	1	18
4. S.	—	—	2	—	5	—	7	—	7
5. S.E.	—	—	—	—	—	—	—	—	—
6. E.	—	—	—	1	2	1	2	2	4
7. N. (eastern)	—	—	—	—	—	1	—	1	1
Loc. unknown					1		1		1
Total...	—	—	16	4	14	6	30	10	40
	—		20		20		40		40

Most of the recaptures at Iceland, it will be seen, were made in the spring (spawning time) and on the south-western part of the Island. From the north and east coasts most recap-

[1]) 1 migrated West. [2]) Migrated West.

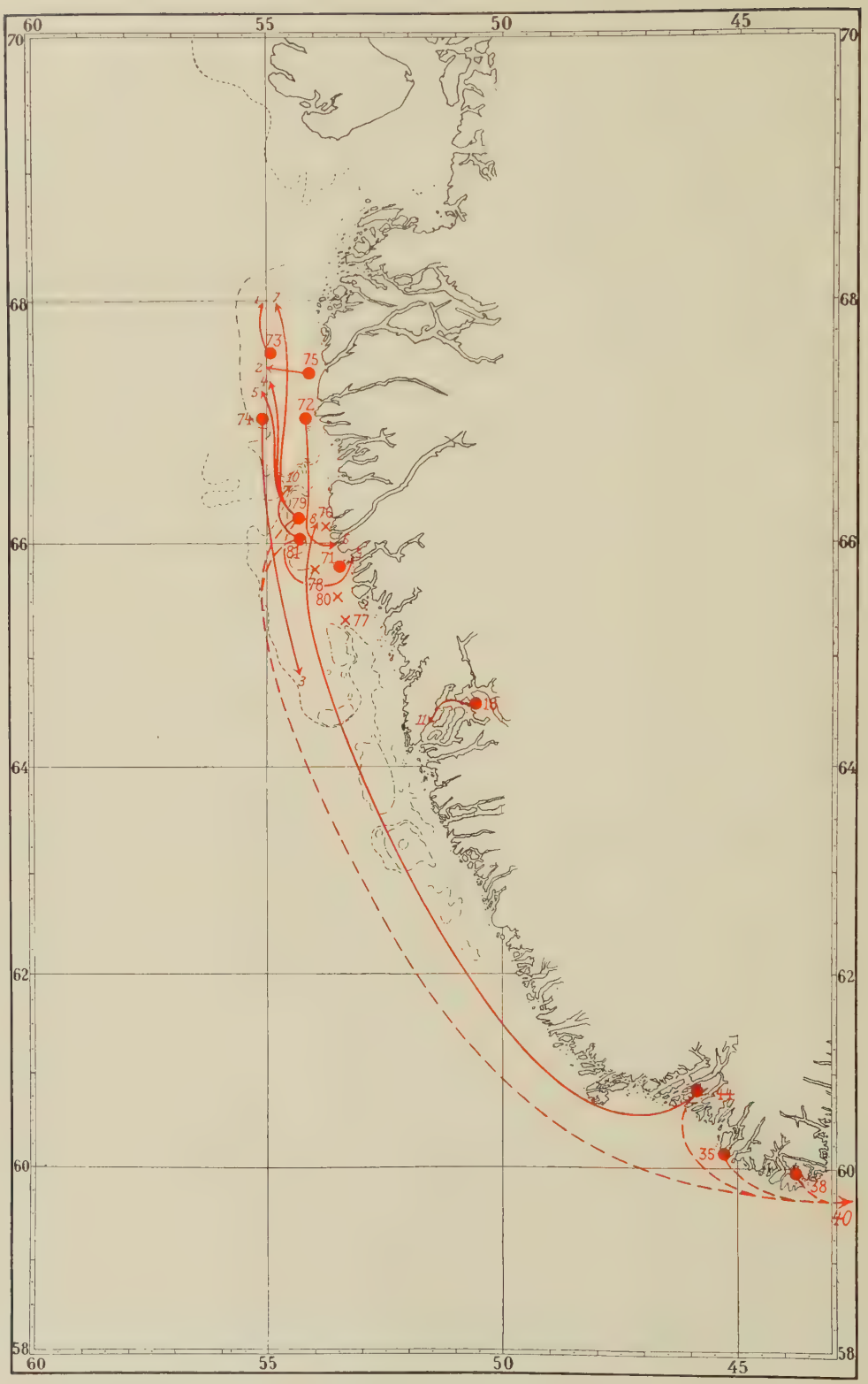

Fig. 24. Migrations of Cod marked **1932.**

Marking experiments 1932.

Recaptures from Greenland (see Fig. 24).

Exp. No. Month	No./Rec.	1932	1933	1934	Exp. No. Month	No./Rec.	1932	1933	1934
73.					**78.**				
Aug.	2/1	17672[1]	—	—	Aug.	38/0	—	—	—
75.					**71.**				
Aug.	18/1	17715[3]	—	—	July	18/1	—	17665*	—
74.					**80.**				
Aug.	33/1	17675[3]	—	—	Aug.	4/0	—	—	—
72.					**77.**				
July, Aug.	14/2	17726*	17732[6]	—	Aug.	19/0	—	—	—
79.					**18.**				
Aug.	340/4	18472[4] 18567[5]	18512[7]	18485[9]	July	41/1	—	—	11546[11]
76.					**44.**				
Aug.	12/0	—	—	—	May, June	163/4	7084*	7086[8] 11459*	11509*
81.					**35.**				
Aug.	98/1	—	—	18378[10]	Sept.	164/0	—	—	—
					38.				
					Sept.	140/0	—	—	—
					Total	1104/16	7	5	4

tures came later, after cessation of spawning, so that here also the results point to a scattering of the Cod to the colder areas after spawning.

The distance travelled lies at least between 640 and 1460 miles, as indicated in the following Table.

Table 34. Minimum distance travelled (Cod emigrants to Iceland).

Miles	600—700	700—800	800—900	900—1000	1000—1200	1200—1400	1400—1500
No. of Specimens.....	7	12	3	4	10	1	2

The Cod which have migrated to Iceland were medium-sized and large fish between 66 and 90 cm.; two were over 90 cm. and one was very large, namely 115 cm. on liberation (and probably 1—2 cm. longer on recapture next year). This is the second largest of the Cod so far reported as having migrated to Iceland.

From the waters of Greenland we have only 16 recaptures of Cod marked in the 1932 experiments. Of these 5 were taken within a distance of 20 miles from the place of marking, 6 have wandered to the north, 4 to the south, though 1 of the former and 1 of the latter might almost be said to have gone in a westerly direction. The wanderings to the north have on the whole been of short extent, but one individual has travelled the very long distance from Julianehaab to Kangamiut, about 400 miles; this specimen measured 73 cm. on liberation. The others have travelled 27, 69, 77 and 115 miles. The southerly wanderings extended to 25, 30, 70 and 135 miles; the longest was from Great to Little Hellefisk Bank. The Cod recaptured in Greenland waters were on the whole large; on liberation they measured 80—121 cm., though one was only 73 cm.; the lengths on recapture were only noted in two cases.

Fig. 25. Emigrants to Iceland from marking experiment **1932.**
○ specimens recaught 1 year and ● 2 years after marking.

2. Time in the sea and rate of migration.

Of the 5 Cod recaptured in the neighbourhood of the place of marking, 2 were caught in the same year they were liberated, 2 in 1933 and 1 in 1934.

Table 35. Number of Cod recaptured during the different years after marking (1932).

No. marked		1 1932	2 1933	3 1934	Total
1104	No. recaptured.....	7+0	5+20	4+20	16+40

Here as in the other experiments the only Cod of interest from the point of view of rate of migration are those retaken at Greenland in the year of marking and at Iceland in the following year. Of the 7 retaken at Greenland in the year of marking, 2 were recaptured quite near the place of liberation; 4 of the remaining 5 have gone northwards (1 however rather to the west)

Marking experiments 1932.

Recaptures from Iceland (see Fig. 25).

Exp. No. Month	No./Rec.	1932	1933	1934	Exp. No. Month	No./Rec.	1932	1933	1934
73.					**77.**				
Aug.	2/0	—	—	—	Aug.	19/0	—	—	—
75.					**18.**				
Aug.	18/0	—	—	—	July	41/0	—	—	—
74.					**44.**				
Aug.	33/0	—	—	—	May, June	163/13	—	7060	7071
72.								7075	7082
July, Aug.	14/0	—	—	—				7094	11457
79.								11456	11511
Aug.	340/10	—	18212	18217				11492	11610
			18260	18290				11639	11620
			18517	18480					11632
			18535	18489	**35.**				
				18579 †)	Sept.	164/11	—	13120	13173
				18603				13159	14449
76.								13166	14479
Aug.	12/0	—	—	—				13167	
81.								13176	
Aug.	98/1	—	—	18341				13177	
78.								13181	
Aug.	38/0	—	—	—				14493	
71.					**38.**				
July	18/0	—	—	—	Sept.	140/5	—	11679	11683
80.								11687	13084
Aug.	4/0	—	—	—					13103
					Total	1104/40	—	20	20

and 1 has travelled south. The distances have all been covered in 1 month or less. Two individuals have travelled at a minimum rate of less than 1 mile per day, 1 at 2.6 miles per day, one 9.2 miles per day and the individual that went south (Cod No. 17675 from Exp. 74) has travelled at a minimum rate of about 15 miles per day, thus about $^3/_4$ mile per hour, the fastest recorded rate of travel, provided the information given is correct. These have all been large fish between 83 and 102 cm. in length and they probably belonged mainly to the 1922 and 1917 year-classes.

Regarding the migrants to Iceland the recaptures for 1932, in all 20, lie between $5^1/_3$ and $12^2/_3$ months after liberation and the distance travelled amounted to at least 670—1080 miles. The following Table shows the varying rate of migration.

Table 36. Rate of migration 1932—33 (recaptures at Iceland).

Miles per day	2.0—2.5	2.5—3.0	3.0—3.5	3.5—4.0	4.0—4.5	Total
No. of specimens.....	4	4	6	1	5	20

It will be seen, that most of them, 14, have travelled at a minimum rate of 2.0—3.5 miles daily; one-fourth (5 spec.) at a rate of 4—4.5 miles daily. Of the 5 speediest migrants 4 have

†) Locality unknown.

travelled from the north edge of the Little Hellefisk Bank to W. Iceland, whilst the 5th has gone from Nanortalik in the Julianehaab District to the same area at Iceland.

X. Experiments 1933.

In this year the work of marking was carried on from M/S "Suðuroy" and M/B "Umarissok"; altogether 625 Cod were marked, at the following localities.

Sukkertoppen District, 8—10, September	150	spec.
Fylla Bank and between Little Hellefisk and Fylla Bank, 12—23, August	150	—
Godthaab District, 16—18, August	100	—
Frederikshaab District, 24, July—8, August	225	—

The measurements of the Cod marked are given in the curves Fig. 26. In the Sukkertoppen District, it will be seen, the fish marked were mainly small and medium-sized. The marking experiments in this district were all made off Napassok and in Kangia Fjord. 73 individuals marked at the first place were apparently all migrating Cod, thin and of light colour. On the other hand, 77 marked in Kangia Fjord belong probably to a fjord race of Cod, at home there and possibly not given to much wandering. The fish in this fjord are distinguished from the wandering Cod by their plump form and dark colour. In racial studies it has been found, that the fjord Cod has the lowest number of vertebrae and number of rays in the 2nd dorsal, of the Greenland Cod examined for this purpose (Hansen 1934 b, p. 9).

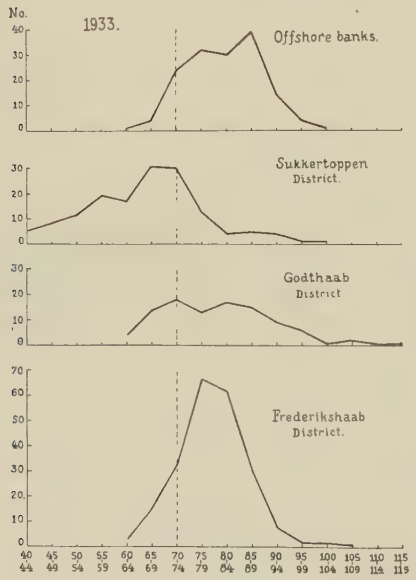

Fig. 26. Size of Cod marked 1933.

The Cod marked on the banks were on the whole medium-sized and larger fish between 65 and 90 cm. in length, most between 75 and 90 cm.; some of them have probably been migrating Cod. The curve representing these fish closely resembles that from Græde Fjord in the Godthaab District. At Frederikshaab it was probably in the main migrating Cod that were marked. They appeared quite suddenly off Frederikshaab at the outermost fringe of islands in the latter half of July and were then in immense shoals. Off Græde Fjord in the Godthaab District the size grouping differs from that at Frederikshaab and resembles more that on the banks; the curve has two maxima. There is an equal proportion of the medium-sized and large individuals in the catches. The Cod marked here are probably in part migrating Cod which have come from the south, and in part fjord Cod which have come out in pursuit of the Capelan (*Mallotus*), which to some extent migrates out from the fjord in the autumn.

The dominant year-classes at the places of marking have been those of 1922, 1924 and 1926. In the Kangia Fjord in Sukkertoppen District the 1926 year-class was by far the largest with about 60 %, the next largest being the 1928 class with about 15 %; the 1922 class contributed 10—15 % and the 1924 class has less than 10 %. On the Fylla Bank the 1922 year-class was dominant with about 40 %, the 1924 class had between 30 and 35 %, the 1926 class be-

tween 15 and 20 %. It is the only marking locality where the 1922 year-class predominates (but in the north at Kangamiut and Holstensborg, where no Cod were marked this year, it was likewise dominant). At Godthaab and Frederikshaab the 1924 year-class was the largest, next the 1926 class, whilst the 1922 class came third with only between 15 and 20 % (Hansen 1934 b, pp. 4—5).

The 1926 year-class was not yet mature in 1933, so far as most individuals were concerned; the fish marked in Kangia Fjord were thus in the main immature; at the other localities, where the 1922 or 1924 classes dominate, most of the marked fish may have been mature Cod.

Of the 625 Cod marked 21 in all have been recaptured, or about 3.4 %. Of these 21 only 4 were recaptured at Greenland (1 in 1933 and 3 in 1934) whilst 17 were recaptured at Iceland in 1934. See App. A, p. 112.

MIGRATIONS & AGE AND SIZE OF MIGRATING COD

1. Direction and extent of the migrations.

The Charts Figs. 27 and 28 indicate the wanderings of the Cod marked in 1933. Migrants to Iceland have come from almost all the marking localities with exception of the Sukkertoppen District.

Table 37. Direction of migrations 1933.

	No. marked	Stationary[1])	Migrated North	Migrated South	Migrated to Iceland
Sukkertoppen Distr.	150	1	0	1	0
Little Hellefisk Bank and Fylla Bank	150	0	0	0	4
Godthaab Distr.	100	1	0	0	3
Frederikshaab Distr.	225	0	1	0	10
Total...	625	2	1	1	17

With a single exception all the recaptures at Iceland were made on the west and south coasts; the exception was taken on the north coast. In two recaptures from Iceland no details of locality are given.

Table 38. Number of recaptures on the different coasts of Iceland of Cod marked in 1933 at West Greenland.

Areas (Chart Fig. 35)	1934			Grand Total
	1/1-31/5		1/6-31/12	
1. N. (western)	—		1	1
2. N.W.	—		—	—
3. W.	12		—	12
4. S.	2		—	2
5. S. E.	—		—	—
6. E.	—		—	—
7. N. (eastern)	—		—	—
Loc. unknown	1	1		2
	15	1	1	17
Total...		17		

[1]) Migration < 20 miles.

It will be seen from Table 38, that the recaptures as usual were made mostly in the spawning time of the Cod and at the principal spawning places at Iceland; the distance from the place of marking of these recaptures at Iceland was at least from 825 to 1200 miles (Table 39).

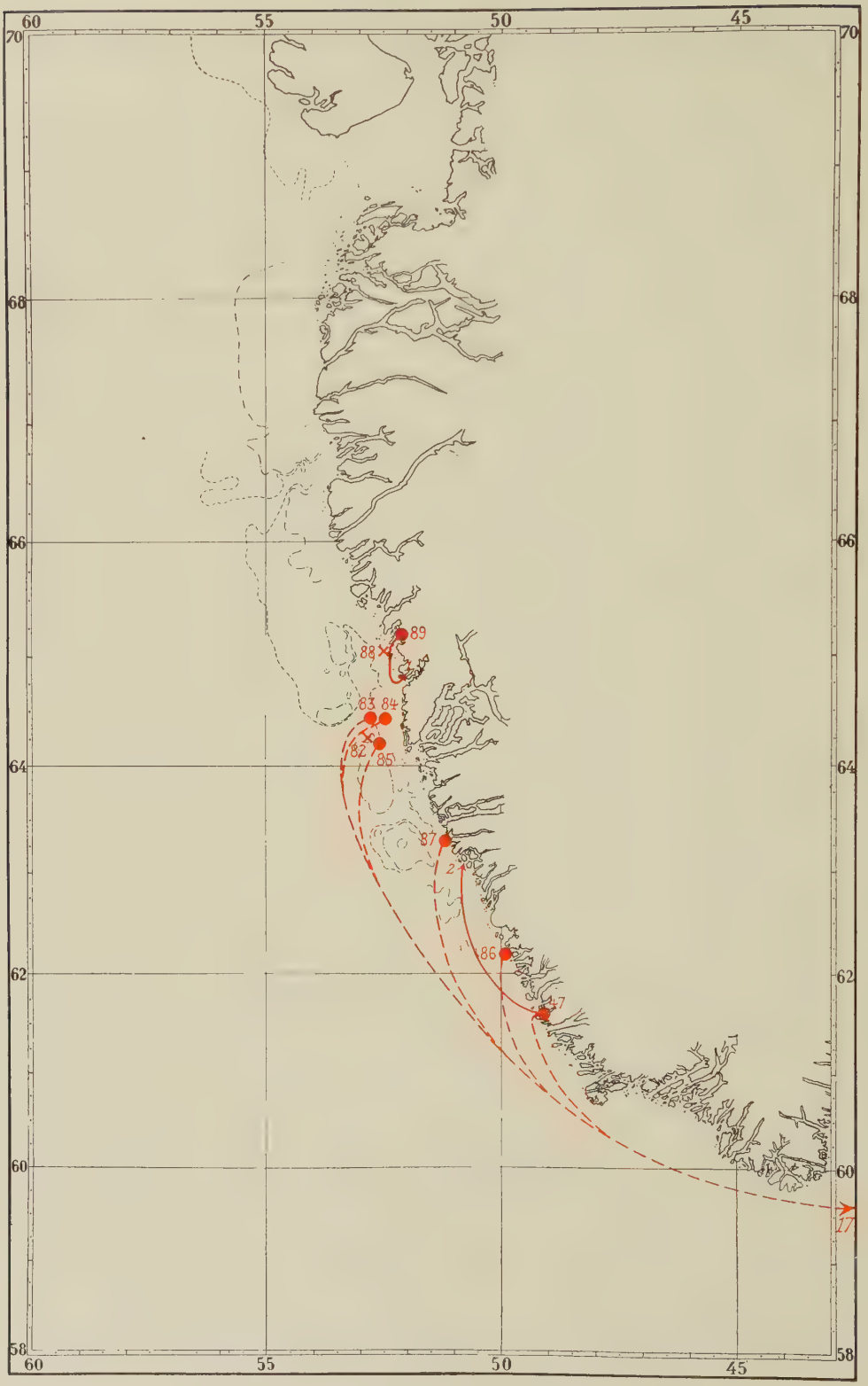

Fig. 27. Migrations of Cod marked **1933.**

Fig. 28. Emigrants to Iceland from marking experiment **1933.**
○ specimens recaught 1 year after marking.

Marking experiments 1933.

Recaptures from Greenland (see Fig. 27).

Exp. No.	Month	No./Rec.	1933	1934
89.	Sept.	77/2	—	13942*
				13993[1]
88.	Sept.	73/0	—	—
83.	Aug.	13/0	—	—
84.	Aug.	4/0	—	—
82.	Aug.	25/0	—	—
85.	Aug.	108/0	—	—
87.	Aug.	100/1	13756*	—
86.	Aug.	100/0	—	—
47.	July	125/1	—	13562[2]
	Total	625/4	1	3

Recaptures from Iceland (see Fig. 28).

Exp. No.	Month	No./Rec.	1933	1934
89.	Sept.	77/0	—	—
88.	Sept.	73/0	—	—
83.	Aug.	13/2	—	14031
				14035
84.	Aug.	4/1	—	14040
82.	Aug.	25/0	—	—
85.	Aug.	108/1	—	14118
87.	Aug.	100/3	—	13760†)
				13809
				13812
86.	Aug.	100/5	—	13657
				13709
				13719
				13729†)
				13730
47.	July	125/5	—	13533
				13566
				13578
				13615
				13643
	Total	625/17	—	17

†) Locality unknown.

Table 39. Minimum distance travelled by Cod emigrants to Iceland.

Miles	800—900	900—1000	1000—1200	1200—1300	Total
No. of specimens	9	3	2	1	15

The migrant Cod have been on the whole of fairly large size; excluding one of 75 cm. on liberation, they measured 79—99 cm. (ultimate length); one even measured 116 cm. on liberation and was probably about 1 cm. longer on recapture next year. This is the largest Cod among the migrants so far reported from Iceland.

In the waters of Greenland only 4 individuals have so far been recaptured; 2 of these may be called stationary, 1 has wandered about 95 miles northwards and another about 35 miles southwards.

2. Time in the sea and rate of migration.

In the year of marking only 1 of the marked Cod was retaken at Greenland; it was recaptured near the same spot 2 days later. All the others were retaken in the following year, 7—11 months after liberation. One individual was retaken near the place of marking after 9 months; 2 had left the place of marking but were retaken at Greenland and had only travelled quite short distances. The one has only travelled 35 miles in 9 months, from Kangia Fjord to Angmasivik; the other has taken quite 11 months for the 95 miles from Neria to Fiskenæsset.

The migrants to Iceland yield more interesting information with regard to the rate of migration. The Table below gives a summary of the minimum rates of travel of Cod marked in 1933 at Greenland and recaptured in 1934 at Iceland.

Table 40. Rate of migration 1933—34 (recaptures at Iceland).

Miles per day	2.5—3.0	3.0—3.5	3.5—4.0	4.0—4.5	4.5—5.0	?	Total
No. of specimens	2	3	6	3	1	2[1])	17

The rate of travel lies for the majority between 3 and 4.5 miles per day.

B. East Greenland.

Experiments 1926—1933.

The occurrence of Cod on the east coast of Greenland has but recently come to our knowledge, though possibly the first Icelanders who crossed over to Greenland in the early centuries were acquainted with the species here (see Schmidt 1931 c, pp. 3—8). Braarud & Ruud (1932) also refer to its occurrence farther north off the east coast in 1929; Thor Iversen (1934), as already noted, marked 200 Cod from the S/S "Veiding" on 3—4, August 1931 off Angmagssalik (65°23′ N., 37°53′ W.); the "Dana" caught some Cod in the trawl farther south on the east coast in 1932 (11/VII; 63°58′ N., 38°55′ W.); at the south-east point of Greenland Paul M. Hansen has taken Cod, among other places, in Nanuseq and Lindenow Fjords 1932 (Hansen 1933, pp. 47—48). The fishing vessels of various countries have likewise met with the Cod at South-east Greenland. When Schmidt learnt about this occurrence of the Cod at

[1]) Locality not given.

Angmagssalik, he succeeded in arranging for marking experiments to be carried out here in the years 1926—32, 572 Cod being marked. At the same time materials were collected for racial investigations, from which he concluded "that the Angmagssalik cod have almost the same numerical values as the highest found at Iceland, so that the results from this side of the investigations seem in no way opposed to the view, that the Angmagssalik cod may be of Icelandic origin" (Schmidt l. c. p. 8; see also Schmidt 1930, pp. 8, 10, 51). The marking in the years 1926—32 was carried out in the neighbourhood of the colony Angmagssalik under the supervision of the Governor A. T. Hedegaard. After Schmidt's death 200 Cod were marked in 1933 on the last Knud Rasmussen Expedition (7' Thule Expedition); the marking was carried out by E. Bertelsen, Stud. mag. Details regarding the marking experiments at Angmagssalik will be found in Appendix A, pp. 114—115.

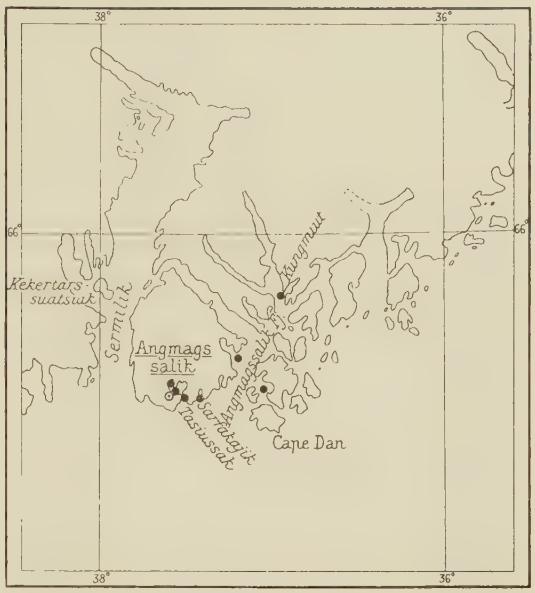

Fig. 29. Localities of marking experiments at East Greenland (see Appendix A p. 114).

In the years 1926—1933 altogether 772 Cod were marked here; the Greenlanders were employed as fishermen and the experiments were made at the following times of year in the neighbourhood of Angmagssalik (see Chart Fig. 29).

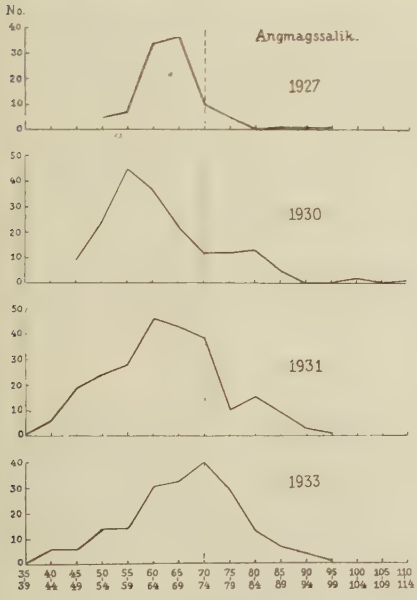

Fig. 30. Size of Cod marked at Angmagssalik.

1926, 16—17, Sept.	2	spec.
1927, 5, Sept.—9, Oct.	100	—
1928, 29, June—16, July	11	—
1930, 21—28, June	182	—
1931, 2, Sept.—9, Oct.	243	—
1932, 26, June—23, July	34	—
1933, 12, Aug.—18, Sept.	200	—

The size of the Cod marked lies mainly between 45 and 85 cm. (see Table 4, p. 10 and Curve Fig. 30); in 1933 the Cod were a little larger than in the previous years. The age analysis of small Cod from this area has been discussed earlier by Schmidt (1931c, p. 5 et seq.); samples of larger Cod from here have been analysed for the years 1931 and 1933. The same age-groups dominate as at Iceland and West Greenland (see Hansen 1934 b, p. 7, Fig. 4 A—B), but in the catches here one notices, that mature Cod are very few in numbers; we may conclude therefore, that the majority of the Cod which grow up in this area emigrate on the inception of maturity, probably at a size of 70—90 cm. Thus, of these 772 Cod marked at East Greenland no fewer than 6 of the 8 recaptures (= 1 %) have come from Iceland, and the size of the individuals recaptured

shows clearly, that the inception of maturity has been the cause of their leaving the cold coastal waters of East Greenland.

a. Migrations.

1. Direction and extent of the migrations.

Of the 8 Cod recaptured only 2 have been taken at East Greenland, where the fishery is quite inconsiderable; these 2 Cod may be considered as stationary, as they have not travelled more than about 30 miles; none have wandered to West Greenland.

The 6 specimens which have migrated to Iceland have presumably followed the deep-sea ridge between East Greenland and north-west Iceland and from there have sought the areas, which offered them a suitable temperature for spawning. Thus, 4 have been retaken at or near the principal spawning places at south-west Iceland during the spawning period (March-April), and they have apparently travelled about 400 miles to get there. Of the last 2 migrants to Iceland one was retaken at south-east Iceland (10, April) and it has probably wandered here immediately after spawning (migration < 600 miles); the other was retaken off Hunaflói on the north coast, but so far on in the summer (18, June) that we may conclude possibly, that it has only come here after spawning at south-west Iceland.

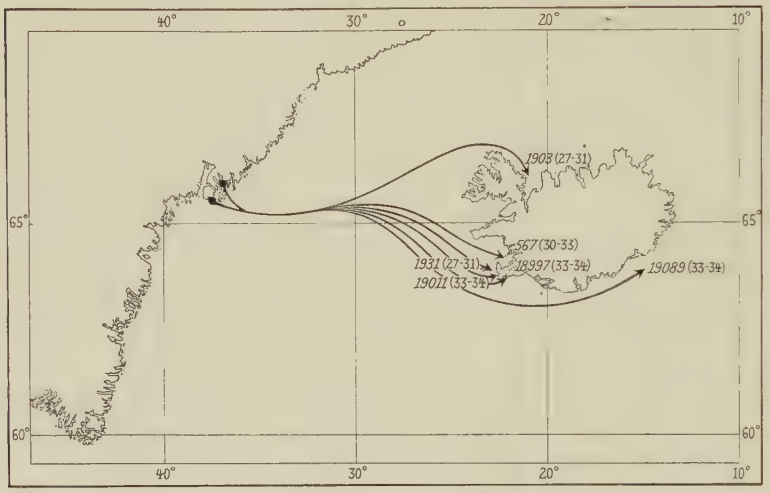

Fig. 31. Emigrants to Iceland from marking experiments carried out at Angmagssalik (see Appendix A p. 114). In parenthesis: year of marking and of recapture.

The distribution of the migrant Cod at Iceland quite agrees with the results of the experiments made by Thor Iversen at East Greenland and also with the distribution at Iceland of the Cod migrants from West Greenland.

2. Time in the sea, rate of migration and season of migration.

Of the 2 Cod which have remained stationary, one was recaptured immediately after marking and thus is of no interest, whilst the other was taken 4—5 months later, but it has only travelled a short distance; this individual was 70 cm. on marking and probably not yet mature.

The 6 Cod recaptured at Iceland differ in the information they give. As will appear from the following summary they were retaken a year after marking or still later.

Table 41. Recaptures of Cod marked at East Greenland[1]).

No. marked		1st	2nd	3rd	4th	5th year	Total
772	No. recaptured	2+0	0+3	0+0	0+1	0+2	2+6

[1]) Those taken at Iceland are given last.

We have seen that the Cod emigrants from West Greenland to Iceland appear there in the year after marking and this may be explained by saying, that the urge to the spawning migration first comes late in the autumn or in the winter before spawning is to take place (in March to May). The same condition is also shown in the marking experiments at East Greenland, as the 3 taken in the second year, according to their length on marking (72—86 cm.), may be considered to have become mature in the winter after marking, whereas the 2 individuals taken in the 5th year after marking were only about 65 cm. on marking and only became mature several years later, presumably in the winter before they were recaptured. The specimen taken in the 4th year may be considered either to have become mature late or to have spawned once or twice before the season in which it was recaptured. But, as the Cod in these waters may seemingly be found still immature up to a length of 90—100 cm., it may possibly have been spawning for the first time (83 cm. on marking, 92 cm. 3 years later).

With regard to the rate of travel during migration we can say nothing, except that the 400—600 miles have been covered during a period of less than 7 months (thus 2—3 miles per day); but the migration may have begun only during late autumn or in the course of the winter, so that the daily migration has been much greater than the time elapsed between marking and recapture would indicate.

b. Age and size of migrating Cod.

We have received the otoliths of 5 of the recaptured Cod, all from Iceland. Age analysis of these has shown, that 2 belong to the 1922 year-class abundant at Iceland-Greenland, and that 3 belong to the likewise abundant year-class 1924. On recapture at Iceland they belonged to the IX—XI groups, which is in agreement with the fact, that the Cod in these waters only reach maturity at a great age. For their age these Cod are rather small, but this is just what we should expect of Cod growing up in such cold waters.

The size of the recaptured Cod lies between 74.7 and 92 cm.; they are thus within the size-class which spawns for the first time in this area.

For further details reference may be made to Appendix A, pp. 114—115.

c. Rate of growth in length.

But little material is available from the East Greenland marking experiments for the study of the growth (see Appendix A, p. 115). Reliable measurements are only available for 4 specimens.

Table 42. Growth and age of Cod marked at East Greenland.

Marked	Recaptured	No. months in sea	Years	Initial length	Ultimate L. & age-group		Growth
5/IX 27	18/VI 31	$45^1/_2$	4	66 cm.	86 cm.	IX	20 cm.
ca. 1/X 27	27/III 31	42	$3^1/_2$	64.4 -	85 -	?	20.6 -
ca. 25/VI 33	20/IV 33	34	3	83 -	92 -	XI?	9 -
ca. 8/IX 33	ca. 13/IV 34	7	$^1/_2$	72 -	74.7 -	X	2.7 -

The annual growth for individuals between 65 and 72 cm. initial size has thus been about 5—6 cm., whilst the growth for the single larger specimen (83 cm. initial size) has only been about 3 cm. This rate agrees quite well with what one would expect in this area, where the temperature of the water is only favourable during a short time of the year for both the Cod and its sources of food.

Section III.

General Survey of the marking experiments at Greenland 1924—1933.

In this Section we shall give a general account of the results of the Greenland marking experiments, so far as one can do so from the detailed material of the single years discussed in Section II. We shall also include various general summaries arising from the material, such as with regard to the season of migration, age and size of migrating Cod, rate of growth in length, intensity of fishery etc.

A. West Greenland.

1. Localities and date.

The marking experiments at West Greenland referred to in this work were carried out during the years 1924—1933 (see p. 4); they have been continued in 1934 and will probably still be continued for a number of years. Cod were marked in the fjords, in coastal waters and out on the banks from Cape Farewell to 68° N. L. at nearly 100 different places (see Chart Fig. 2, p. 7 also Appendix A and B, pp. 94—116). The marking was carried out between 25, May and 1, November, mostly in the months of July, August and September, as shown in Table 5, p. 13.

2. Number of fish marked and recaptured.

In the years 1924—33 altogether 6811 Cod were marked; in 1934 a further 954 Cod were added. Tables 43—45 give a summary of the numbers marked each year, along with the number of recaptures from each year's experiment together with the numbers recaptured in the respective years. The returns for Greenland and Iceland are given separately, and the total recaptures are also noted.

Table 43.
Recaptures in the different experiments
(‰ = pro mille).

Year	No. marked	Recaptures at		Total Recaptures	Recaptures ‰	Recaptures at Greenland ‰	Recaptures at Iceland ‰
		Greenland	Iceland				
1924	414	14	2	16	39	34	5
1925	410	41	..	41	100	100	..
1926	342	6	2	8	23	17	6
1927	201	12	..	12	60	60	..
1928	109	..	4	4	37	..	37
1929	500	16	18	34	68	32	36
1930	1454	32	75	108[1])	74	22	52
1931	1652	58	39	97	59	35	24
1932	1104	16	40	56	51	15	36
1933	625	4	17	21	34	7	27
1934	954	7	..	7	7	7	..
Total	7765	206	197	404[1])	52	27	25

Table 44.
Recaptures in the respective years.
(‰ = pro mille).

Year	No. in the Sea	Recaptures at		Total Recaptures	Recaptures ‰	Recaptures at Greenland ‰	Recaptures at Iceland ‰
		Greenland	Iceland				
1924	414	1	..	1	2	2	..
1925	823	15	..	15	18	18	..
1926	1150	16	..	16	14	14	..
1927	1335	16	1	17	13	12	1
1928	1427	6	..	6	4	4	..
1929	1921	9	..	9	5	5	..
1930	3366	16	7	23	7	5	2
1931	4995	32	46	78	16	7	9
1932	6021	43	35	78	11	5	6
1933	6568	22	57	79	12	3	9
1934	7443	29	51	80	11	4	7
Total	..	207[2])	197	404	..	..	..

[1]) 1 included without particulars. [2]) 2 included without year of recapture.

Table 45. Cod marking experiments at West-Greenland 1924—34.

Number of recaptures from Greenland and Iceland (heavy type).

Year of marking	No. marked	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	?	Total
1924	414	1	..	4	5+**1**	1	2	..	1	**1**	..	..	..	14+**2**
1925	410	..	15	11	2	2	3	3	3	1	1	..	..	41+**0**
1926	342	..	..	1	3	..	..	1+**1**	1+**1**	..	..	..	..	6+**2**
1927	201	..	..	..	6	3	..	2	..	..	..	1	..	12+**0**
1928	109	..	..	..	..	..	..	**1**	**3**	..	..	..	..	0+**4**
1929	500	..	..	..	..	..	4	4+**5**	2+**7**	5+**3**	**2**	1+**1**	..	16+**18**
1930	1454	..	..	..	..	..	..	6	11+**35**	7+**16**	4+**14**	4+**10**	1	33+**75**
1931	1652	..	..	..	..	..	..	..	14	23+**15**	11+**21**	9+**3**	1	58+**39**
1932	1104	..	..	..	..	..	..	..	..	7	5+**20**	4+**20**	..	16+**40**
1933	625	..	..	..	..	..	..	..	..	..	1	3+**17**	..	4+**17**
1934	954	..	..	..	..	..	..	..	..	..	..	7	..	7
Total	7765	1	15	16	16+**1**	6	9	16+**7**	32+**46**	43+**35**	22+**57**	29+**51**	2	207+**197**

We learn from the Tables, that the percentage of returns all experiments included is 5.2 %, but leaving out 1934 it is 5.8; of these half were retaken at Greenland, half at Iceland. From Table 44 we also see that the highest percentage of recoveries at Greenland falls in the year 1925 (owing to unusually heavy fishing at the places where the Cod were marked that year); the lowest percentage at Greenland is naturally that for the first year (1924), but in the last two years, 1933—34, the percentage is also low. With regard to Iceland we see, that the recaptures only begin rightly in 1930, but then increase rapidly to exceed the Greenland percentage. As mentioned several times in the preceding pages one of the reasons for this phenomenon is, that the rich year-classes 1922 and 1924 then became mature and migrated to Iceland in order to spawn.

3. Size of fish marked.

The size of the Cod marked at West Greenland lies mainly between 50 and 115 cm.; about 37 % were less than 70 cm., 55 % lay between 70 and 100 cm. whilst only 8 % were over 100 cm. The majority thus consisted of Cod which were coming on to maturity or had just reached that stage. The size of Cod taken in the commercial fishery at Greenland has been discussed more closely in Hansen & Jensen 1930, pp. 16—39 and 1931, pp. 12—32.

4. Depths where recaptures were made.

It is of some interest to note, that the Cod emigrants to Iceland were almost all caught in localities with depths over 50 m. (down to ca. 250 m.), whilst the great majority at Greenland were taken in depths of less than 50 m. A comparison of the available data is given in the following summary.

Table 46. Depths of recaptures.

Nos. recaptured at: Depth:	< 50 m.	50—100 m.	100—150 m.	> 150 m.[1])
Greenland	65	37	8	3
Iceland	4	35	39	31

At Iceland, as mentioned elsewhere, the majority were taken in April—May at the spawning places where depths between 50 and 150 m. are specially selected; at Greenland the catches were made chiefly from June to September when the Cod seek the shallower waters, where the summer warmth is most felt and their food most abundant (*Mallotus*, *Ammodytes* etc.). We may add, that even if all sizes of Cod, up to the very large, can be met with in depths of less than 50 m. at Greenland, yet as elsewhere there is a tendency for the smaller fish to be more numerous here than in deeper water. The material from Iceland shows no marked difference in regard to size for the different depths; naturally because they are all mature Cod taken mainly in the spawning time.

5. Inshore and offshore markings.

In the marking experiments importance was attached to liberating Cod in all three zones, fjords, coastal waters and out on the banks. Owing to *inter alia* the topography of the banks at West Greenland few Cod were marked on the banks in the southernmost parts, in fact practically none.

The following Table shows that a considerable number have been marked within each of the zones mentioned (see also Table 2, p. 8).

Table 47. Marking experiments on banks, in coastal waters and in the fjords.

	No. of Cod marked 1924—33		Recaptures		
1. on offshore banks . .	1960	specimens	108	specimens	5.5 %
2. in coastal waters . .	2706	—	163	—	6.0 %
3. in the fjords	2145	—	126	—	5.9 %
	6811	specimens	397	specimens	5.8 %

It appears from the Table, that the percentage of Cod recaptured is on the whole the same for the three different zones and this might well have been expected in the case of a species, such as the Cod, which is a great wanderer, in a certain period of its life at any rate. Closer consideration of the conditions from north to south along the west coast reveals however certain interesting features in this connection (see pp. 72—75).

6. Migrations.

In the previous Section (II) by means of charts and curves we have endeavoured to illustrate the migrations undertaken by the Cod during each of the ten years of the marking experiments. We shall try now to bring the results together as briefly as possible, adding the conclusions that can only be drawn from the total material of recaptures for the ten years.

[1]) Greatest depth at Greenland 256 m., at Iceland 350 m., but very few taken at depths greater than 250 m.

a. Direction and extent of the migrations.

The migrations include on the one hand those which keep within the Greenland area itself (restricted migrations) and those on the other hand which have led the Cod to Iceland (extended migrations). Within the West Greenland area again we have obviously two kinds of migrations: shorter wanderings, made by both young and older Cod, without doubt only food wanderings or wanderings conditioned by local hydrographical conditions; longer wanderings, in which older Cod mainly are concerned as they travel northwards along the west coast of Greenland to the northern banks (Great Hellefisk Bank etc.); some however have travelled greater distances southwards from the place of marking, and these possibly signify in some cases the beginning of the migration to Iceland.

Table 48. Extent and direction of migrations.

Year of Experiment	Number liberated	Stationary (< 20 miles)	Migrated 20—100 miles		Migrated > 100 miles		Emigrated to Iceland	Unknown migration	Total recaptured
			North	South	North	South			
1924	414	8	1	3	—	1	2	1	16
1925	410	24	3	7	5	—	—	2	41
1926	342	5	1	—	—	—	2	—	8
1927	201	9	—	—	2	1	—	—	12
1928	109	—	—	—	—	—	4	—	4
1929	500	11	—	3	2	—	18	—	34
1930	1454	14	5	9	3	1	75	1	108
1931	1652	24	8	17	8	1	39	—	97
1932	1104	5	5	3	2	1	40	—	56
1933	625	2	—	1	1	—	17	—	21
Total..	6811	102	23	43	23	5	197	4	397

Fig. 32. Sketch of emigration of Cod from Greenland to Iceland.

In Table 48 we give a summary of the number of Cod which come within the different categories; stationary refers to all Cod recaptured within less than 20 miles of place of liberation; migrants are those which have travelled a greater distance, but among these we have some whose wanderings north or south may be regarded simply as dictated by the search for food. We have thus distinguished, in the columns for the migrants over 20 miles, between those which have travelled less than 100 miles and those which have gone this distance or more. The Charts Fig. 32—36 give details with regard to these various migrations. We may summarize the results in the following manner.

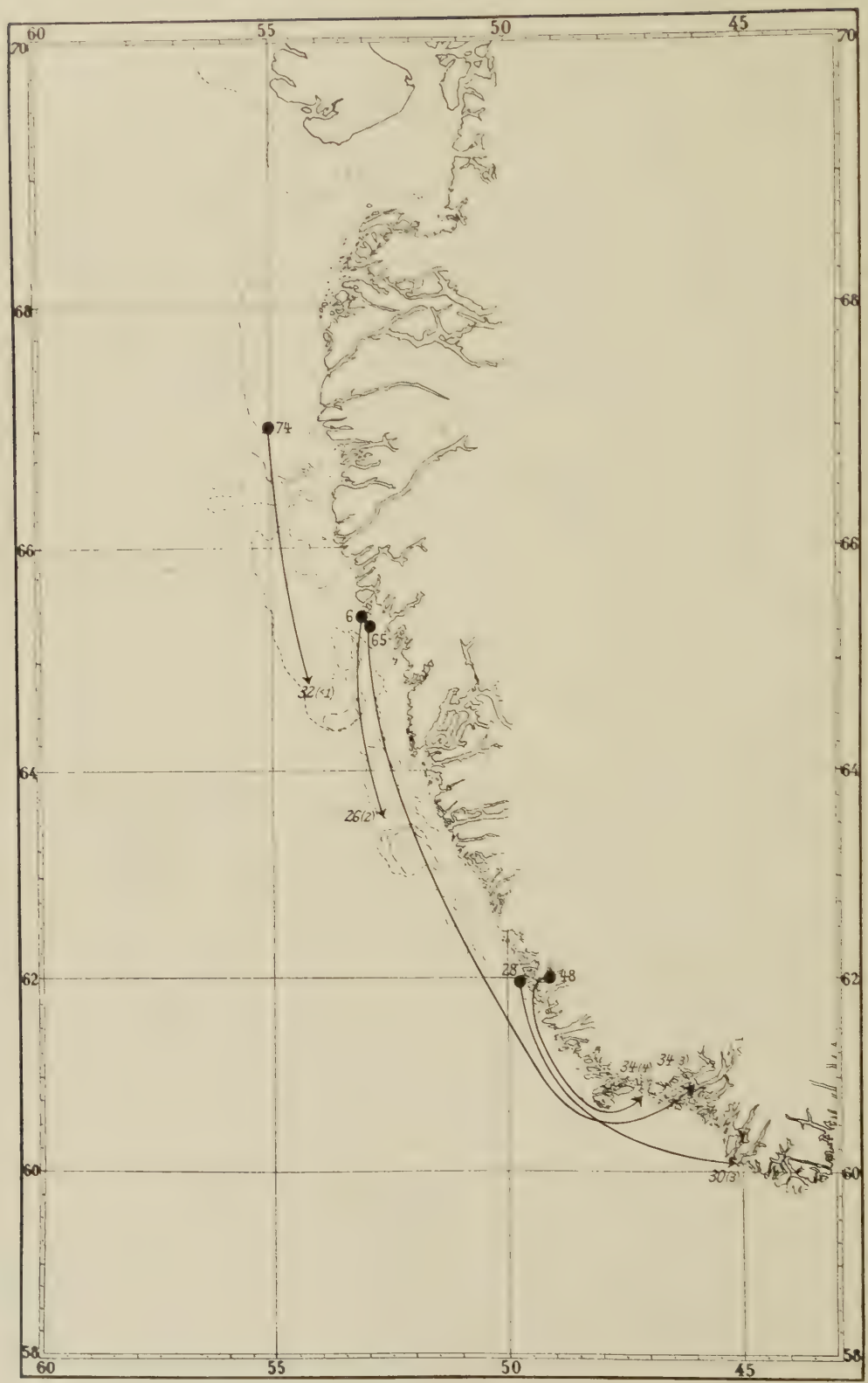

Fig. 33. Long southward migrations at West Greenland. (Marking experiment, year of recapture and number of years in the sea indicated).

Fig. 34. Long northward migrations at West Greenland. (Marking experiment, year of recapture and number of years in the sea indicated).

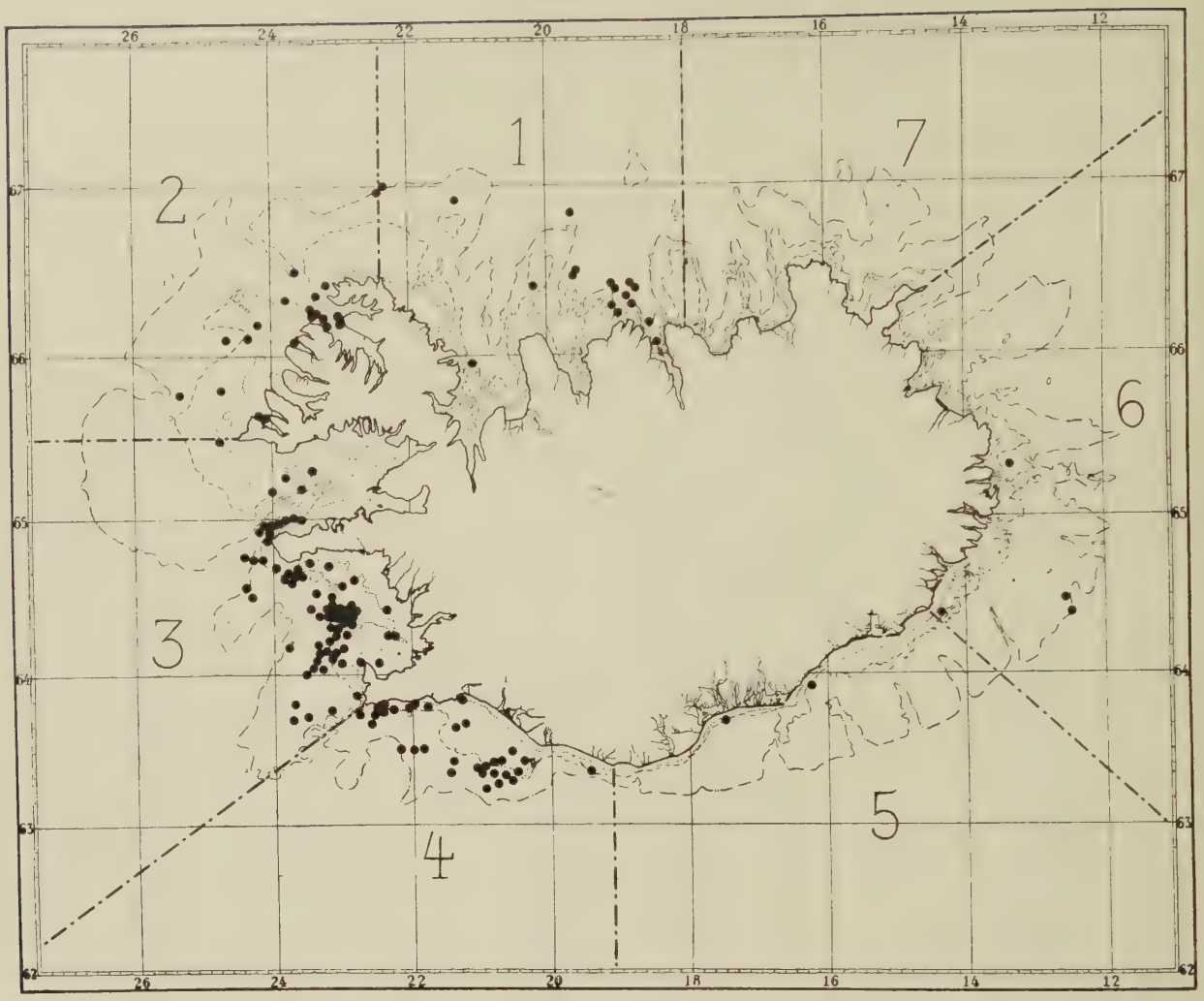

Fig. 35. Localities of recaptured emigrants at Iceland during the spring (up to June 1st). See Table 49, p. 72.

A. Stationary or nearly stationary Cod; these include especially (1) immature Cod, known in all regions where the Cod occurs as in the main stationary and (2) very old Cod, which obviously become more and more stationary with age.

B. Migrants.

I. *Recaptured inside the West Greenland area.*

a. Cod migrating south or north along West Greenland.

Migrated more than 100 miles south. This group includes but few Cod (5) which have gone south from the place of marking, possibly connected with beginning of their migration to Iceland but also possibly embracing individuals, which for one reason or another have undertaken slightly extended wanderings (in search of food or suitable temperatures and the like for spawning at Greenland itself). See Chart Fig. 33; also p. 78.

Migrated more than 100 miles north. Includes a number of Cod (23) which have migrated chiefly north to the banks; these are in great part large Cod (> 100 cm.)

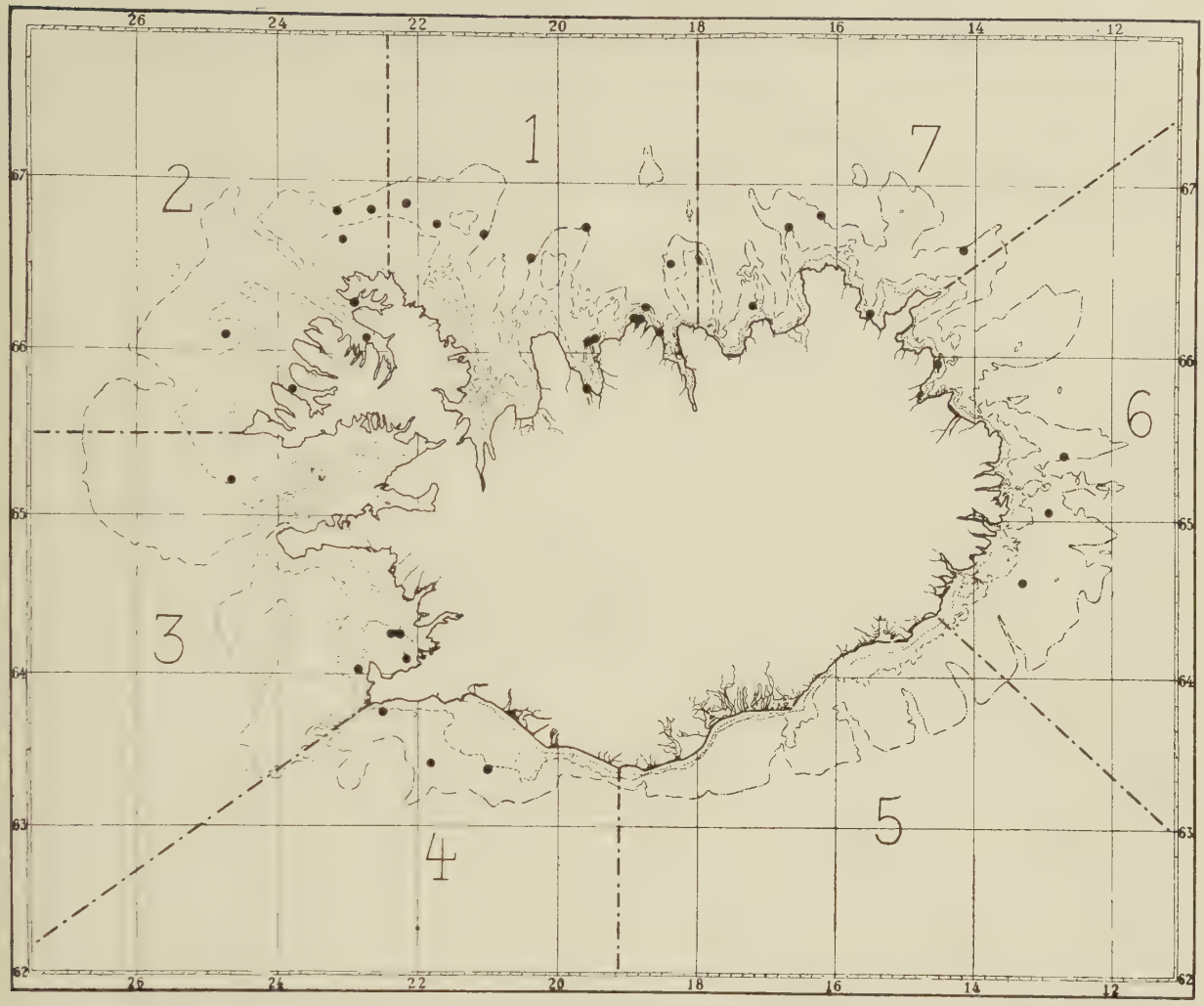

Fig. 36. Localities of recaptured emigrants at Iceland during summer and autumn (later than June 1st). See Table 49, p. 72.

which no longer or only to a small extent undertake extended pelagic wanderings, but prefer to keep near the bottom. The wanderings may be undertaken (1) in search of food or suitable hydrographical conditions, perhaps both together or (2) for the purpose of spawning, as this takes place to some extent especially on the banks about 63°—67° N. Lat. (perhaps with centres round the Fylla Bank and Little Hellefisk Bank, as well as at the southern end of the Great Hellefisk Bank). See Chart Fig. 34, p. 69.

b. Migrated from the banks into the fjords. Only very few specimens are known to have made such a migration (see p. 74).

c. Migrated from the fjords to the banks. Likewise only very few specimens (see p. 74).

The size of the Cod belonging to the last two categories lies between ca. 60 and ca. 130 cm.; the wanderings may be undertaken for the sake of food or under the influence of hydrographical conditions, but may also be connected with the urge to seek spawning places (in fjords, e. g. Godthaab Fjord, or on the banks); see further p. 74.

II. *Recaptured at Iceland on spawning migration.*

Migrants to Iceland number in all 197 individuals; the distance travelled has been at least 700 - 1200 miles. The migration obviously is only taken part in by Cod intending to spawn[1]); hence most recaptures are made in the spawning time at West and South-west Iceland. The direction of migration is believed to be round Cape Farewell, along the east coast and thence presumably across the deep-sea ridge between East Greenland and North-west Iceland. Fig. 32 illustrates schematically the supposed route of migration. After spawning apparently the Cod scatter at Iceland, and in recent years there seems also to have been a return migration to the waters of Greenland; the Charts Fig. 35 and Fig. 36 represent the total numbers recaptured at Iceland before and after the 1st of June; extension of the wanderings to the colder coasts of Iceland on the completion of spawning, arbitrarily placed at June 1st, is also obvious.

Table 49. Percentage of Cod retaken in different areas at Iceland[2]) (cf. Figs. 35—36).

Areas at Iceland	1 N.[3])	2 N.W.	3 W.	4 S.	5 S.E.	6 E.	7 N.[4])
Spring:							
No. of Cod taken	18	19	78	32	2	4	0
% - - - -	11.8	12.4	51.0	20.9	1.3	2.6	0.0
Summer and autumn:							
No. of Cod taken	13	7	5	3	0	4	5
% - - - -	35.1	18.9	13.5	8.1	0.0	10.8	13.5

Thus, on the warmer coasts of Iceland (N. W.+W.+S.) 84 % were retaken before June 1, i. e. in the spawning time, whilst only 16 % were retaken during this period on the colder coasts (N.+E.+S.E.); on the other hand, in the second half of the year only 40 % were taken on the warmer coasts, but 60 % on the colder.

The relatively few recaptures (9) on the eastern and north-eastern coasts of Iceland in the second half of the year indicate that emigration from Iceland to Greenland in the years of investigation has probably been greater than the movement to the colder Icelandic coasts, where previously the fishery for spent Cod has been much greater than in recent years. An emigration from Iceland of spent Cod to West Greenland with recaptures there in July-August has been demonstrated in recent years (see Schmidt 1931 a, pp. 8—10, and Tåning 1934, pp. 7—8).

b. Differences in migration with localities and years.

A study of the emigration from the extensive coasts of West Greenland reveals several interesting features. Enquiring whether the emigration is the same or uniform from north to south along the west coast we find, that in the years of investigations it is absolutely greatest from the southernmost parts of West Greenland; this is seen in the accompanying Table 50.

[1]) One may note, that a few emigrants to Iceland may be immature fish which by chance have accompanied the mature emigrants; similar cases are known among birds.

[2]) Total: 190 specimens (+ 5 without localities and 2 no date).

[3]) Western part.

[4]) Eastern part.

Table 50. Emigration to Iceland from the different districts of West Greenland 1924—34.

District	No. marked 1924—33	No. recapt. at Iceland 1927—34	%
Egedesminde	58	1	1.7
Holstensborg	784	14	1.8
Sukkertoppen	1773	30	1.7
Godthaab	1569	25	1.6
Frederikshaab	673	25	3.6
Julianehaab	1954	102	5.2
Total...	6811	197	2.9

As the emigration to Iceland practically speaking only began in 1931, only 1 being taken in 1927 and 7 in 1930, the available material is insufficient for a study of the eventual changes over a longer series of years.

On the other hand it is of interest to compare the number of emigrants with the number of stationary Cod for the northern part of the west coast (Egedesminde-Godthaab districts) and for the southern part of the west coast (Frederikshaab and Julianehaab districts). As we shall see later, a stronger emigration has taken place after the 1929 marking, furthermore few markings were made in the southern area before 1929; consequently we have divided the material into two periods 1924—28 and 1929 –33. Further, the material is divided into two categories according to whether the Cod were marked out on the banks or in the coastal waters and fjords; the banks namely are of very small extent in the south and in consequence very few Cod were marked there. Tables 51—52 show the results. Cf. also Fig. 37.

Table 51. Recaptures of Cod from marking experiments **1924—28.**

Area	Total number marked		Markings on offshore banks			Markings in coastal waters and in the fjords		
			Number marked	Rec. Greenland	Rec. Iceland	Number marked	Rec. Greenland	Rec. Iceland
Northern ...	1378	No.	514	36	5	864	34	3
		%	100	**88**	**12**	100	**92**	**8**
Southern ...	98	No.	3	—	—	95[1])	3	0
		%	100	0	0	100	**100**	**0**

Table 52. Recaptures of Cod from marking experiments **1929—33.**

Area	Total number marked		Markings on offshore banks			Markings in coastal waters and in the fjords		
			Number marked	Rec. Greenland	Rec. Iceland	Number marked	Rec. Greenland	Rec. Iceland
Northern ...	2806	No.	1443	35	32	1363	40	30
		%	100	**52**	**48**	100	**57**	**43**
Southern ...	2529	No.	0	—	—	2529	51	127
		%	—	—	—	100	**29**	**71**

[1]) Marked in Frederikshaab District; no markings in Julianehaab District.

Of the Cod marked in the years 1924—28 few have migrated to Iceland from the northern area and none from the southern. It will be noticed, that the proportion between emigrants to Iceland and stationary Cod is the same for the banks and coast-fjords. Among the Cod marked in the years 1929—33, on the other hand, we find numerous emigrants from all the areas where marking was carried out. And it is very striking, that whilst the number of emigrants and of those recaptured at Greenland is almost the same for the northern area, whether the markings on the banks or in the coast-fjord areas are considered, the number of emigrants to Iceland from the southern area is more than double the number of individuals recaptured at Greenland.

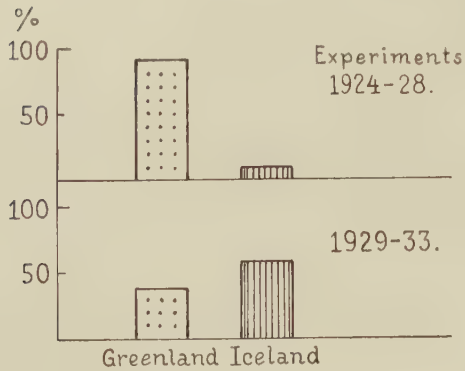

Fig. 37. Percentage of recaptures from experiments in 1924—28 and in 1929—33.

If we divide the material according to whether the marking took place on the banks, in the coastal waters or inside the fjords, we obtain naturally most recaptures at Greenland in the zones where the marking was carried out, that is to say, most recaptures respectively from the banks, from the coastal waters or from the fjords. This can be seen from the following synopsis.

Table 53. Number of recaptures from markings carried out on offshore banks, in coastal waters and in fjords.

		Offshore banks	Coastal waters	Fjords	Total
Total liberated		1960	2706	2145	6811
Recaptured at Greenland	Offshore banks	57	5	5	67
	Coastal waters	12	54	12	78
	Fjords	2	5	47	54

We see further from this Table however, that the marking on the banks has yielded more recaptures (12) in coastal waters than in the fjords (2), whilst the coastal markings have just as many recaptures on the banks as in the fjords and the fjord markings have more recaptures in the coastal waters (12) than out on the banks (5). There is, therefore, no distinct wandering from the one to the other zone, as one might expect if the spawning, for example, took place exclusively inside certain fjords or exclusively out on the banks. This quite confirms the experience previously gained of the Cod's spawning at Greenland, a certain amount of spawning having been found both in certain fjords and out on the banks. The exchange however between the banks and fjords is but limited.

Turning now to the Cod which have emigrated to Iceland we may divide the material into a northern and a southern zone of West Greenland, as the conditions in these have proved to be widely different; this has been done in the following Table 54.

It will be seen from this Table — apart from the fact already noted, that most emigrants to Iceland have come from the southern area — that the Cod marked inside the fjords seek Iceland in somewhat less degree than the Cod marked in coastal waters or out on the banks. The possible reason for this is, that the Cod in the fjords find better conditions for spawning here than the stock on the banks find out there and therefore remain in the fjords at Greenland (probably we have a special race of fjord Cod here).

Table 54. Number of emigrants to Iceland marked at Greenland on the banks, in coastal waters and in fjords.

		Offshore banks	Coastal waters	Fjords
Markings in Northern Area	Total liberated	1957	1323	904
	Rec. Iceland	37 = 1.9 %	23 = 1.7 %	10 = 1.1 %
Markings in Southern Area	Total liberated	3	1383	1241
	Rec. Iceland	0	76 = 5.5 %	51 = 4.1 %

c. Time in the sea and rate of migration.

The marking method used (see TÅNING 1933) seems to have been very satisfactory compared with various other methods used both in Denmark formerly and in other countries, as we have had recaptures of marked Cod as late as the eighth year after marking. As most of the Cod marked were 4—5 years old or more and as a year-class begins to fade quickly from the stock fished when it reaches 15—17 years, this means that the mark may remain on the fish for most of its life. As far as we know, Cod have never been recaught so long after marking as has been the case with some of the individuals marked at Greenland.

Whilst the recaptures of marked Cod at other places have been greatest in the year of marking, we see in the present experiments how the recaptures have been most numerous in the second and third years, and even in the fourth year almost as many have been recaptured as in the first; as shown in the following synopsis.

Table 55. Recaptures in the 1st, 2nd. . . . 9th year.

		1[1].	2.	3.	4.	5.	6.	7.	8.	9.	Total
Greenland . . .	No.	*55*	*62*	*32*	*27*	*9*	*7*	*3*	*3*	*1*	*199*
	%	27.6	31.2	16.1	13.6	4.5	3.5	1.5	1.5	0.5	
Iceland	No.		*92*	*65*	*24*	*13*	*2*	*0*	*0*	*1*	*197*
	%		46.7	33.0	12.2	6.6	1.0	0.0	0.0	0.5	
Total . . .	No.	*55*	*154*	*97*	*51*	*22*	*9*	*3*	*3*	*2*	*396*
	%	13.8	38.9	24.5	12.9	5.6	2.3	0.8	0.8	0.5	

It will be noticed, that no Cod were taken at Iceland in the year of marking; this is connected naturally with the fact, that the migration is undertaken by Cod approaching maturity and the movement from Greenland thus presumably only begins in the autumn or in the winter; the Cod are then retaken on the spawning grounds at Iceland mainly in March to May of the following year.

At Greenland 88 % of all recaptures there were made in the course of the first to the fourth year and at Iceland as much as 92 % of all recaptures there were made in the second to the fourth year. Almost 50 % of the recaptures at Iceland fall in the year immediately after the marking (47 %); in the course of the third and fourth year almost equally many (33 + 12 = 45 %), but there is a great fall in the number of recaptures after that.

Of the Cod which have been 6—8 years in the sea (altogether 8 specimens) some have proved very stationary whilst others have travelled great distances, one even to Iceland; those which have remained quite stationary have usually been large individuals already when they were marked.

[1]) 1. year = marking year.

Rate of migration. The Cod recaptured at Greenland have in most cases shown rather low rates of travel, >1— ca. 10 miles daily, but a few have shown how rapidly the Cod can travel; for example, one individual (marked 1932) shows a speed of at least 15 nautical miles per day (provided the information given is correct).

With regard to the Cod migrants to Iceland, we do not know the precise route followed nor the date for the beginning of the migration, nor again the date of arrival at the spawning ground; consequently, our estimate of the minimum rate of travel can only be indefinite. If we assume, however, that the emigration begins late in the year, that the arrival at Iceland must generally occur some time before the date of recapture and that the route taken is really considerably longer than the shortest line on the Chart, we come to the reasonable conclusion, that the actual rate of travel achieved by the Cod during the spawning migration must be several times greater than the minimum rate calculated.

As we have seen from the discussion of the rate of migration in Section II this minimum lies between ca. 2 and 5.5 miles per day, most often about 3 miles per day; possibly therefore the actual rate may be as much as 10 miles per day or more. This would fall in line with the fact, that the latter rate has been found in the case of Cod marked on the spawning grounds at Iceland and recaptured about 3 months later at West Greenland (see TÅNING 1934, p. 8); presumably also the migration to the spawning grounds would be more rapid and more direct than the wanderings from the spawning places when the Cod are more interested in seeking their food.

d. Season of migration.

The present marking experiments afford very interesting information with regard to the question: at what time of year do the Cod undertake their migrations? This only applies to the material concerned with the Cod emigrants to Iceland, whereas the data regarding the Cod retaken at Greenland itself still fall short of enabling us to draw general conclusions concerning the more local movements of the Cod stock on the west coast of Greenland.

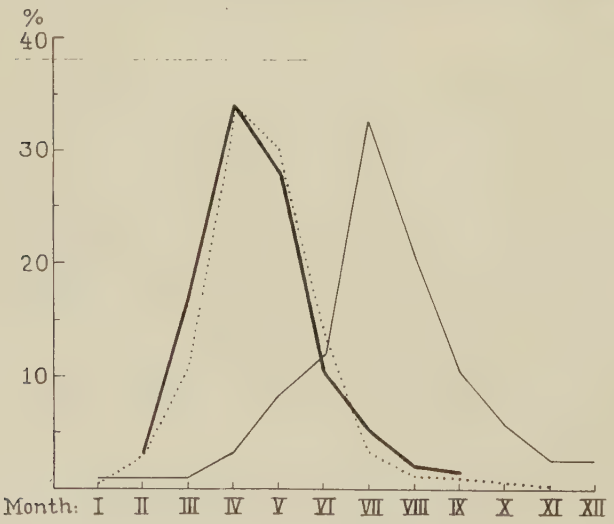

Fig. 38. Season of recapture (Percentage of recaptures in different months).
——— Cod marked at Greenland and recaptured at Iceland.
..... Cod marked on spawning grounds off South-Iceland and recaptured again at Iceland.
——— Cod marked at Greenland and also recaptured here.

We may first consider the distribution of the total recaptures over the different months of the year. The data for this purpose are given in Table 56 and represented graphically in the curves Fig. 38. We have brought together here month by month the numbers of Cod recaptured at Greenland itself and at Iceland, including also some material obtained from marking experiments of recent years on the spawning grounds at South-west Iceland. The last-mentioned material consists of about 4800 spawning Cod, from which up to the present we have had 382 recaptures from the Iceland area itself (in addition, some recaptures from Greenland, Newfoundland, the Faroes and Norway; see i. a. TÅNING 1934, p. 8).

The curves Fig. 38 show clearly, that

the Cod marked at West Greenland which have migrated to Iceland were recaptured almost exclusively during the spring, in March—June, thus in the spawning season, whilst those which have remained at Greenland (or recaptured there again) were mainly taken during the summer fishery in June—September; this fishery is almost entirely based on immature and spent Cod.

Table 56. Number and percentages of Cod recaptured during the year (marking experiments at spawning grounds off Iceland 1925—34 included in the Table).

Marking Area	Rec. Area	Month:	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	?
Greenland 7765 specimens marked	Greenland	No.	2	..	2	6	16	23	64	42	20	12	5	5	10
		%	*1.0*	..	*1.0*	*3.0*	*8.1*	*11.7*	*32.5*	*21.3*	*10.2*	*6.1*	*2.5*	*2.5*	..
	Iceland	No.	..	6	31	65	53	20	10	4	3	..	..	..	5
		%	..	*3.1*	*16.1*	*33.9*	*27.6*	*10.4*	*5.2*	*2.1*	*1.6*	..	..	..	..
Iceland 4802 spec. marked	Iceland	No.	2	11	40	124	111	52	12	5	4	3	1	..	17
		%	*0.5*	*3.0*	*11.0*	*34.0*	*30.4*	*14.2*	*3.3*	*1.4*	*1.1*	*0.8*	*0.3*	..	..

We may notice that the curve, illustrating the monthly recaptures of spawning Cod marked at Iceland and again recaptured there, is almost identical with the curve for the emigrant fish from Greenland recaught at Iceland. This means, that the emigrants appear on the Iceland banks at the same time as the stock marked at Iceland itself, and not appreciably earlier or later. Further, the curves naturally give a good picture of the intensity of fishing throughout the year of the spawning and recently spent large Cod at Iceland, and of the mixed stock at Greenland. We may add that marking of immature Cod on the cold coasts of Iceland (north and east) has given a recapture curve, which in regard to time of recapture very closely resembles the curve we have obtained for the Cod liberated and recaught again at West Greenland itself. From the above Table and Curve it will be seen, that no Greenland marked Cod were taken at Iceland in the months of October—January; how far they may have disappeared altogether from the Iceland area, our material does not permit us to judge.

We have already mentioned previously at several places, that Cod emigrants to Iceland first appear there in the year after marking (earliest 24, February), even when the marking was so late as in October. This shows, that the journey is undoubtedly made late in the autumn or in the course of the winter. With regard to the starting time of the Cod emigrants to Iceland, we can conclude but little from the few southern migrants on the west coast of Greenland, reported as yet; in the first place the recaptures are not at all numerous late in the year, and again it has not yet been possible owing to the severe cold conditions to undertake marking in November—February at Greenland so as to narrow down the probable time of departure. Our material for determining the exact time of departure of the emigrants from West Greenland is still far too scanty to be of much service.

In Tables 57 and 58 we give on the one hand a summary of the few south (and north) migrants that fall within the period October to April and thus in some instances may be supposed (in the case of the southern migrants) to indicate the beginning of the Iceland migration; on the other, a summary of the number of all north and south migrants throughout the different months of the year.

We may note here certain features arising from this material. Counting up the number

of Cod which have travelled more than 20 miles whether north or south, we learn that there were 46 north migrants and 48 south migrants at West Greenland, thus an equal number practically; but of these migrants only one[1]) very large Cod going north occurs in the period October to April, whereas no fewer than 11 south migrants come within the same period as recaptures and these were mainly Cod of the migrating class (see Table 57). Thus, we have a certain amount of confirmation of the view, that at least some of the south migrants are really to be regarded as on their way to Iceland.

Unfortunately the rate of migration, or size of individuals etc., can give no basis for determining, which of the individuals in Table 57 could be considered as having begun the migration to Iceland; the time of marking lies in all cases so remote from the date of recapture, that the rate of migration is very low for Cod of these sizes.

Table 57. Migrations south, West Greenland, recaptures in October—April.

No.	Marking	Rec. date	Months in the sea	App. distance, miles	Sex	Init. & ultim. size
7673	$^{24}/_{8}$ 29	$^{21}/_{11}$ 29	2	20	?	87 — ?
7925	$^{3}/_{10}$ 29	$^{20}/_{3}$ 31	$17^{1}/_{2}$	30	?	61 — ?
8353	$^{10}/_{7}$ 30	$^{27}/_{10}$ 30	$3^{1}/_{2}$	85	?	90 — ?
8879	$^{26}/_{8}$ 30	$^{25}/_{4}$ 31	8	74	?	70 — ?
9180	$^{14}/_{9}$ 30	$^{23}/_{10}$ 34	$49^{1}/_{3}$	100	♂	61 — 81.2
10740	$^{26}/_{6}$ 31	$^{24}/_{4}$ 32	10	80	?	111.5— ?
12148	$^{9}/_{8}$ 31	$^{24}/_{4}$ 32	$8^{1}/_{2}$	60	?	99 — ?
12449	$^{15}/_{8}$ 31	$^{4}/_{1}$ 32	$4^{2}/_{3}$	80	?	107 — ?
17732	$^{19}/_{8}$ 32	$^{17}/_{10}$ 33	14	70	?	103.8—104 ?
18485	$^{19}/_{8}$ 32	$^{11}/_{10}$ 34	$25^{3}/_{4}$	30	♂	82 — 85
11546	$^{18}/_{7}$ 32	$^{6}/_{3}$ 34	$19^{1}/_{2}$	25	?	80 — 84
Migrations north, West Greenland, recaptures in October—April.						
12648	$^{6}/_{9}$ 31	$^{11}/_{11}$ 31	$2^{1}/_{4}$	300	?	130 — ?

Table 58. Recaptures month by month of Cod which have migrated more than 20 miles north or south.

Months:	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
North.....	..	..	..	..	4	2	12	16	9	..	1	..
South.....	1	..	2	3	3	7	12	8	1	4	1	..

As mentioned previously, the north migrants at West Greenland are the somewhat large to very large Cod and we see from Table 58 how their capture has taken place chiefly in the months of July to September; it is well-known, that large Cod keep to the northern banks, especially north of 66°. Some of these Cod have probably been at Iceland and returned again.

e. Periodicity in the interchange with Iceland and causes of the migration.

Periodicity. We have noted several times in previous pages, that the emigration to Iceland first began in the winter of 1929—30 or the spring of 1930, especially in the case of Cod marked in 1928—1929, as only one individual had been taken in a preceding year (1927),

[1]) A second Cod (No. 8812, Exp. No 45) was possibly taken in the month of December, after a journey northward of only about 35 miles; as the date of recapture is uncertain, we have not included this specimen.

though the marking experiments had begun in 1924 (see Table 45, p. 65). The emigration has undoubtedly been increased, perhaps to some extent produced, by the appearance of the very abundant year-class 1922 and the somewhat weaker 1924 class, but other causes, especially hydrographical, have certainly played their part. In recent years the migration of Cod from Greenland to Iceland has greatly increased. Considering the number of recaptures in the two areas for the years 1929—32, we find a slight preponderance in favour of Greenland, but in the years 1933—34 we have more than twice as many recaptures at Iceland as at Greenland; see Table 59.

Table 59. Number of recaptures in 1924—28, 1929—32 and 1933—34 at Greenland and Iceland.

	Greenland		Iceland	
	Number	%	Number	%
1924—28	54	98.2	1	1.8
1929—32	100	53.2	88	46.8
1933—34	51	32.1	108	67.9

The great increase of emigrants in 1933—34 may to some extent at any rate be ascribed to the fact, that two abundant year-classes — 1922 and 1924 — have now added their quota to the migration. We have still too few observations, however, and for too short a period to be able to determine precisely the periodicity in the emigration.

Causes. This brings us to a consideration of the causes of the migration and various conditions connected therewith.

Whilst certain movements at West Greenland itself are undoubtedly food wanderings, some of these may be considered as being prompted either by changes in the hydrographical conditions or by the urge of maturing organs; as, for example, certain of the north and south migrants and a few migrants from the fjords and coastal waters to the banks and the reverse. But our material is as yet too meagre and no object would be gained by endeavouring to find a solution at present. On the other hand, there can be no doubt in the case of the emigrants to Iceland; according to all we have been able to extract from the observations described in foregoing pages, the driving force can alone be the inception of maturity. The age analyses to be mentioned later (p. 82) emphasize the correctness of this conclusion[1]). On the other hand, we have no certainty about the course followed by the emigrants on their way to the Iceland spawning grounds, nor consequently about the factors which direct their way. These are most probably hydrographical in the first place, temperature and currents or both, but the bottom contours of the sea perhaps contribute to their guidance towards Iceland (submarine ridges, see e. g. TÅNING 1934. "Nature" p. 326).

7. Size and age of recaptured Cod.

In the preceding part of this work (Section II) we have constantly referred to the size as well as the age of the migrating Cod; we may now proceed to a more general treatment of the whole material, with the aim in view of obtaining more light on the subject.

Size. Dealing first with the length of the Cod recaptured both at Greenland and Iceland, we have to note unfortunately that information regarding the length on recapture has been

[1]) See footnote p. 72.

Table 60. Initial and ultimate length of Cod recaptured at West Greenland and Iceland.

(Number of specimens in length-groups.)

5 cm length groups	Recaptured at **Greenland** Initial	Ultimate	Recaptured at **Iceland** Initial	Ultimate
130—134	1	1	..	..
125—129	..	..	..	..
120—124	3	..	..	..
115—119	5	4	2	..
110—114	13	5	..	..
105—109	14	4	1	..
100—104	12	9	4	3
95— 99	19	9	7	11
90— 94	17	6	12	14
85— 89	18	20	30	21
80— 84	20	8	37	26
75— 79	19	13	27	21
70— 74	16	7	28	13
65— 69	18	4	22	9
60— 64	10	2	14	1
55— 59	9	1	9	..
50— 54	4	..	4	..
45— 49	1	..	..	..
Total..	199	93	197	119

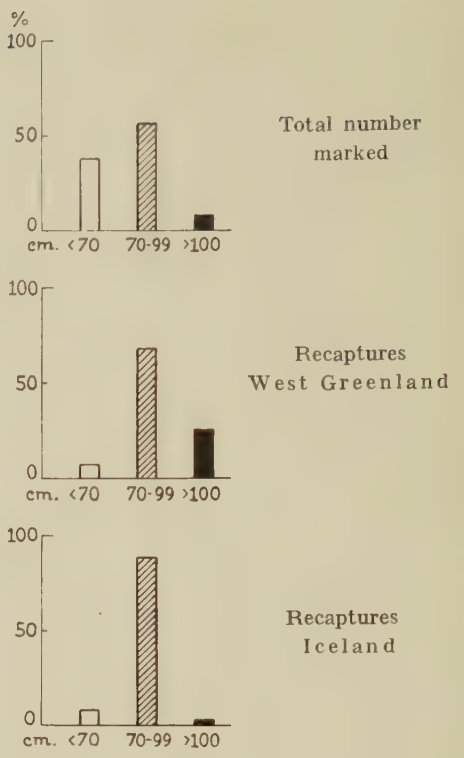

Fig. 39. Percentage of recaptured Cod from West Greenland and Iceland in various size-groups compared with total number of specimens marked of these size-groups (top-figure).

Table 61. Number and Percentage of Recaptures belonging to various size-groups (Markings 1924—1933).

	Size groups (cm.)		38—49	50—69	70—99	100—119	120—135	Total
Initial length	Specimens marked	No.	33	2492	3757	464	52	6798
		%	**0.5**	**36.6**	**55.3**	**6.8**	**0.8**	**100**
	Recaptures at Greenland	No.	1	41	109	44	4	199
		%	**0.5**	**20.6**	**54.8**	**22.1**	**2.0**	**100**
	Recaptures at Iceland	No.	..	48	142	7	..	197
		%	..	**24.4**	**72.1**	**3.5**	..	**100**
Ultim. length	Recaptures at Greenland	No.	..	7	63	22	1	93
		%	..	**7.5**	**67.7**	**23.7**	**1.1**	**100**
	Recaptures at Iceland	No.	..	10	106	3	..	119
		%	..	**8.4**	**89.1**	**2.5**	..	**100**

received in by no means all cases, fewest from Greenland. In the accompanying Tables 60 and 61 we give a summary of the numbers for Greenland and Iceland arranged in size-groups on marking and on recapture. In spite of all shortcomings in the measurements received we see at once, that the emigrants to Iceland are principally the medium-sized Cod of

between 70 and 100 cm. in length[1]), whilst relatively few of the really large Cod migrate to Iceland; the two largest among the emigrants measured ca. 115—117 cm. The really large Cod may be considered to become more sedentary or stationary with age and thus remain at Greenland (and Iceland, if arrived there). The conditions with regard to size-groups appear even more clearly in Fig. 39 (from Table 61), where we have also included a graph to show the length distribution of all Cod marked at West Greenland.

We see clearly, that the principal size-groups which migrate to Iceland are those between 70 and 99 cm. and that a preponderance of large, old Cod over 100 cm. are caught at Greenland, where they lead a more sedentary life, moving northwards, perhaps following the prevailing current over the banks; again, that few small Cod are recaptured both at Greenland and Iceland, even though many of the Cod marked at Greenland originally belonged to the size-groups of these small Cod. It is only when the Cod reach about 70 cm. that they are subjected to a strong commercial fishery in these northern waters.

As will be noted below (p. 82), a number of the Cod emigrants to Iceland supplied material for age-analysis and in the case of about 70 of them reliable information as to the length on recapture was also received at the same time. On the basis of this material we have drawn up the accompanying Table on the average size of the migrating age-groups.

Table 62. Average size of Cod emigrants from Greenland to Iceland (ultimate size).

Age-group	Length variation	No.	Average size
XII	83 — 97	7	89.3
XI	78 —100	12	87.6
X	75 — 99	20	84.7
IX	66 — 92	23	77.7
VIII	68.5— 82	8	73.5
VII	70	1	(70)
VI	63	1	(63)

The majority of the emigrants are from the southern districts of West Greenland where the growth is much less than farther north; consequently, the average size of the age-groups is lower than one might expect, to judge, for example, from the average lengths of Greenland Cod given by Jensen & Hansen 1930, p. 22 and 1931, p. 18. It may be, possibly, that the larger individuals of a certain, mature age-group are not so much inclined to migrate as the smaller, and that the growth of the enormously numerous 1922 year-class has been less than that of other year-classes in earlier years owing to the increased competition or to other cause; our material, however, is too meagre for any conclusion to be drawn.

We have already noted that the Cod, which migrate northwards within the Greenland area especially late in summer and beginning of autumn, are mainly large Cod. Thus, of the 23 north-going Cod which have travelled 100 miles or more about one half (13) are 90—130 cm. in length, the rest (10) being between 60 and 85 cm. In 1931 especially (somewhat less in 1930 and 1933) this movement to the north was very noticeable (see Chart Fig. 34). The quite or nearly quite stationary Cod at West Greenland are for the most part either immature or old Cod, which perhaps have lived 7—8 years almost at the same place apparently. As the many Cod marked in recent years gradually become older, we shall obtain a better material for the study of this question; we need not discuss the matter further here.

[1]) The Cod which migrate to West Greenland from Iceland also belong to this size-group; see Tåning 1934, p. 8.

Age. After we had succeeded in instructing the fishermen to send us otoliths or/and scales and vertebrae of the recaptured marked Cod, we have obtained a material of great value. From the Iceland fishermen especially we have received many otoliths and these have been a very great help, as it is of importance to know the age of the Cod which have made the long journey to Iceland.

About 125 samples of otoliths, scales etc. have been sent in; a few only contain scales which have been indeterminable and have thus been excluded; but there remain 101 usable samples of Cod which have travelled to Iceland, though only 21 of Cod recaptured at Greenland.

In the following Table (63) we give a summary of the age-groups represented in the material of emigrants to Iceland. The figures in the second row give the numbers believed to belong to the respective age-groups, but with a query; 5 specimens are uncertain but belong quite clearly to the VIII—XII groups, thus to the groups which otherwise dominate; 5 specimens from East Greenland are included in the material. Though several Cod were taken fairly early in the year, they have been referred nevertheless to the same age-groups as the others from the same year.

Table 63. Age-groups of Cod emigrants to Iceland.

Age-groups:	VI	VII	VIII	IX	X	XI	XII	VIII—XII	>XII	Total
Number	1	1	7	26[1])	23[1])	14	8	..	..	80
No. of uncertain det.	1	..	..	5	5[1])	2[1])	2	5	1	21
Total	2	1	7	31	28	16	10	5	1	101

We may conclude from this, that very few Cod migrate to Iceland before they are close on 8 years old (here indicated as VIII-gr.); the youngest is about 6 years old. The majority of the emigrants belong to the IX—XI-gr., which falls in line with what we know about the age for inception of maturity in these waters.

From the following Table (64) we see further, that almost the whole material is distributed over the year-classes 1922, 1924 and 1926, which were dominant at Greenland in these years; most belong to 1922, quite the dominating year-class, somewhat fewer to 1924 and only a few to the 1926 year-class, which still only 8 years old has hardly made its presence felt among the emigrants.

Table 64. Year-classes of Cod emigrants to Iceland.

Year:	1919 & older	1920	1921	1922	1923	1924	1925	1926	?	Total
Number	..	..	..	44[2])	1	30[2])	1	4	..	80
No. of uncertain det.	1	..	..	9[3])	..	5[2])	..	1	5	21
Total	1	..	..	53	1	35	1	5	5	101

As will be noted, the emigrants from East Greenland belong to quite the same dominating age-groups and year-classes as those from West Greenland.

[1]) 1 in each group, total 5, liberated at Angmagssalik, East Greenland; the rest liberated at West Greenland.

[2]) 1 in each group from East Greenland.

[3]) 2 from E. Greenland.

Table 65. Age-groups of Cod recaptured at Greenland.

Age-groups:	VIII	IX	X	XI	XII	VIII—XII	XIII	>XV	Total
Number	2	..	4	1	3	..	2	..	12
No. of uncertain det.	..	1	2	..	2	2	..	2	9
Total	2	1	6	1	5	2	2	2	21

Table 66. Year-classes of Cod recaptured at Greenland.

Year:	1912	1913	1915	1916	1917	1919	1920÷[1])	1920+[2])	1922	1924	1926	Total
Number	1	1	1	..	2	1	..	..	2	2	2	12
No. of uncertain det.	..	..	..	1	..	..	2	2	1	3	..	9
Total	1	1	1	1	2	1	2	2	3	5	2	21

Considering now the material of Cod marked and recaptured at Greenland we see from the Tables 65 and 66, that many more of the older year-classes, from spawnings before 1920, are represented here than in the Iceland material: 9 individuals from spawnings before 1920 against 12 from spawnings after that year. Compared with the year-classes of the emigrants to Iceland the difference is very striking, as only 1 of the emigrants was born before 1920. No fewer than 6 specimens of year-classes earlier than 1920 are represented in the recaptures from Greenland before 1928; the rest were taken after 1930. When we see further, that four-fifths of the Cod recaptured at Greenland and whose ages are known, belong to the VIII—XII groups, thus the same groups observed among the Iceland emigrants from 1930 onwards, we can only regard these differences as supporting the view already mentioned, that emigration to Iceland during this period seems to have made a beginning in the winter of 1929—1930, when the abundant 1922 class began to be mature. We may add, that about 1000 Cod were marked at Greenland before the 1922 year-class had reached the markable size; there seems therefore only one reason, why recaptures at Iceland were not made in the years just after the beginning of marking at Greenland in 1924, namely, that very little or no emigration took place in the years 1924—26.

In the following Table again we have brought together the number of emigrants to Iceland in such a manner that age-group, year-class and year of recapture at Iceland can all be seen; only the certain data included.

Table 67. Number of Cod emigrants to Iceland arranged according to age-group, year-class and year of recapture.

Age-groups:	VI	VII	VIII	IX	X	XI	XII
Year of recapture: 1930	..	..	1	..	..	..	..
1931	..	1	1	15	..	..	..
1932	1	..	2	..	6	..	..
1933	..	..	..	10	..	14	..
1934	..	..	3	1	17	..	8
Year-class				1926		1924	1922

[1]) Older than 1920 class. [2]) Younger than 1920 class

We see from this, as shown already, that some few year-classes dominate in the catches, but likewise that in the year 1932 there were few recaptures at Iceland even of the rich 1922 class, which was marked in great numbers the previous year at Greenland. As this year-class reappeared again and strongly in 1933, the difference points to a certain amount of fluctuation in the number of emigrants from year to year (cf. also the Tables 43—45, pp. 64—65). See further pp. 87—88. Even in 1934 not a few of the year-class 1922 still occur among the emigrants, but it will probably not appear much longer.

8. Rate of growth in length.

The material for estimating the growth in length of the recaptured Cod is somewhat deficient on a number of points[1]), information with regard to length on recapture often being quite wanting or the measurement made in a different manner from that used in fisheries investigations, e. g. length without head or without tail and so on. It has been found necessary therefore to exclude some of the records as quite unusable; the remainder still contains admittedly not a few errors, but it is not possible to eradicate these. Consequently one must be careful in using the material available. Appendix A, pp. 94—115 gives all the details and in the Tables 68 and 69 all the data with regard to growth used in the following have been summarized in 10 cm. groups, including the marked Cod recaptured at Greenland and at Iceland; the year is divided into first and second half, the 1st of July being chosen as the arbitrary point of separation. The increment is given in cms., e. g. 6.5—7 ɔ: 6.5 cm and 7 cm respectively.

Table 68. Growth in cms. of Cod. Recaptured at Greenland.

Initial size in cm.	Recaptured at Greenland in													
	1. Year		2. Year		3. Year		4. Year		5. Year		6. Year	7. Year	8. Year	9. Year
	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.	July-Dec.	July-Dec.	July-Dec.	July-Dec.
110—119			1			3	3.5							
100—109		0-0.6		5-5							16			30
90—99	0	0-1-1	1	4-4	8	14		2-16[3])	6		9	11-22		
80—89		1-2-3-3	2-4	1-3-3-5-6.5-7	4-9	3-4-4.1-10	8-9						31[4])	
70—79	0			4-5	4	13[2])	7-8-9	8-10.4-11-12-12-14		26				
60—69			7-8	3-4-7-7		8-8-11-12-19.7	19.5	8-12-18.5-29	7	20.2	17.5			
50—59			4-8		13	21	13	17-19		15				
45—49									32					

[1]) The weight is sometimes given by the fishermen, but the material is too unequal to be used here.
[2]) + 1, date unknown, growth 5 cm.
[3]) + 1, date unknown, growth 13 cm.
[4]) + 1, date unknown, growth 21 cm.

Table 69. Growth in cms. of Cod. Recaptured at Iceland.

Initial size in cm.	Recaptured at Iceland in									
	2. Year		3. Year		4. Year		5. Year		6. Year	9. Year
	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	Jan.-June
100—109	1									
90—99	0-1-1-1-1-3	4	4-7							
80—89	0-0-0.5-1-1-1-1-2-2-2-2-2.5-3-3-3-3-4.6-5-7	0-6	3-3-3.5-4-4-5-6 6-6-6-8-8-9-15.7		6-7-8-14-15	11				
70—79	0-0-0.4-1-1-1-1.4-2-2-2-4-6	1.8	2-3-3-5-6-7-9-9-10-11-12.3		8-8-9.4		9-12		12	
60—69	0-0-3		3-5-5-5-6-8-8-8	14	6.5-7-10-11-13.8-14-16-17-17		14-21	18		
50—59			5.5			36	10.5-12-14.3-15-19-23-32		23	39.5

The Tables clearly show great individual differences in growth; one notes also that the growth is slow on the whole, much less than for example at the Faroes and in the North Sea, yet greater than that known from several other northern areas (cf. works by Strubberg, Graham, Sæmundsson, Friðriksson, Sund, Hansen & Jensen, Tåning and others). The material, however, is too meagre to be profitably considered in detail.

The question of most practical interest to be answered, in connection with the migrations to Iceland we have noted, is just: what difference in growth is noticeable between Cod recaptured at Greenland and those which migrate to Iceland? Would it be possible to give a final answer to this question from the available material?

As we have seen, the material is scanty and does not allow us, for example, to investigate the difference in growth between the two categories of Cod mentioned to within a cm. or even each 5 cm. group. For this reason we have preferred, to gain a view over the conditions, to arrange the material in 20 cm. groups and then take the average for each year. Fig. 40 shows the result for Cod of about 50—69 cm. initial size. We see then a very decided difference in the growth of the fish retaken at

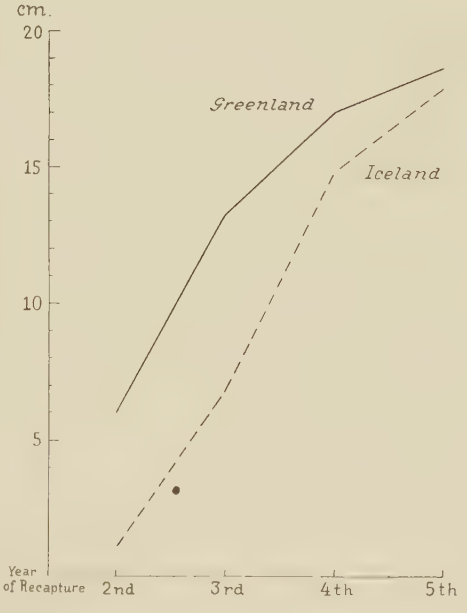

Fig. 40. Average increment in cms. of Cod 50—69 cm. in length.

——— recaptured at Greenland in second to fifth year after marking.

------ recaptured at Iceland in second to fifth year after marking.

Iceland from those retaken at Greenland; in Cod of these sizes the growth seems to be much better in the Greenland fish. The cause of this difference is partly that most recaptures from Iceland are from the first half of the year, from Greenland from the second half of the year (longer season of growth), partly that growth is probably checked on the inception of first maturity; consequently, emigrants of the group ca. 50—69 cm. will show lesser growth than the fish of the same group that remain at Greenland. The latter in the majority of cases undoubtedly have not yet reached the stage of spawning. But as the fish reach a length of 70—80 cm. the majority will spawn for the first time and then the growth apparently becomes uniform for both the Cod which remain as spawners at Greenland and the emigrants which go to spawn at Iceland. Further, as the interchange between Greenland and Iceland takes place both ways, the picture of the difference in growth between the older Greenland and Iceland fish will also be wiped out to some extent.

Examining now the growth of Cod of 63.5—75 cm. (ultimate length) which have emigrated to Iceland, without doubt almost all immature on marking, we obtain the following average rate of growth.

Table 70. Average growth of emigrants to Iceland 63.5– 75 cm. (ultimate length).

Year of marking = 1st year	Average growth	No. of spec.
Recaptured in 2nd year	1.1 cm.	10
— 3rd —	5.3 —	9
— 4th —	9.4 —	6
— 5th —	14.2 —	5

We see that fish, which may be considered to have been immature on marking but have emigrated to Iceland in the course of the first year, have only grown very little in spite of the fact that many of them have gone through a whole growth season or at least a goodly part of it. On the other hand, fish which have had one or more seasons longer in the sea at Greenland or Iceland or at both, have increased in length either before or after the first spawning, the increase amounting to about 2.7—3.7 cm. per season. The growth in length thus seems to come to a stop some time before the sexual organs become ripe for the first time in the migrants to Iceland. Further material is, however, necessary before we can give a final answer to the question mentioned.

9. Relation to the fishery.

As the material is comparatively small, we cannot discuss in any detail the distribution of the recaptures over the different countries which fish in these waters, and similar questions. But we may consider certain matters, quite provisionally, which may be of some value for the future work.

Of the Cod marked at East Greenland we have received 5 recaptures from Iceland fishermen, 2 from Greenlanders and 1 from a German source.

From Table 71 we see how the recaptures at Greenland and Iceland are distributed among the fishing vessels of the different nations in the two periods 1924—28 and 1929—34. It appears clearly, that whilst the Norwegians fished at Greenland mainly in the first-mentioned period, the British, Portuguese, Canadian and Newfoundland (and partly French) fishing was restricted to the second period. Compared with the available fisheries statistics the figures give

Table 71. Number of Cod recaptured by fishermen of different nationalities in the years 1924—34.

	Greenland:			Iceland:		
	1924—28	1929—34	Total	1927	1930—34	Total
Greenland	25	103	128	..	..	..
Faroese	7	17	24	..	15	15
Iceland	..	..	..	1	144	145
British	..	4	4	..	17	17
French	1	12	13	..	4	4
German	..	..	..	..	9	9
Norwegian	21	..	21	..	7	7
Portuguese	..	6	6	..	..	..
Canadian	..	2	2	..	..	..
Newfoundland	..	1	1	..	..	..
No. (and %) of recaptures	54 (3.7 %)	145 (2.7 %)	199 (2.9 %)	1	196	197
Total marked	1476	5335	6811			

some information regarding the but little known fishery on the banks in these waters. The emigration of Cod to Iceland began seriously about 1930 and only a single recapture was made there in the first period.

It is of interest to note, how the recaptures at Greenland and Iceland compare with one another in numbers. From Table 44, p. 64, we have extracted the following brief synopsis.

Table 72. Percentage of recaptures at Greenland and Iceland.

Year	Number at Greenland	Number at Iceland	% at Greenland	% at Iceland
1927	16	1	94.1	5.9
1930	16	7	65.7	34.3
1931	32	46	40.9	59.1
1932	43	35	55.1	44.9
1933	22	57	27.8	72.2
1934	29	51	36.2	63.8

From this Table we see, that between $^1/_2$ to $^7/_{10}$ths of all recaptures in the later years were made at Iceland. One may also notice, as mentioned earlier, how there is a fall in the number of emigrants to Iceland in 1932, but a majority in the years 1931 and 1933. In the years 1931 and 1933 probably there has been a considerable migration of the year-classes 1922 and 1924, as 9 year old fish (which become mature in great numbers just at this age, see p. 82); consequently the explanation of the decrease in 1932 would seem to be, that emigration of the 9 year old fish has then been small owing to the fact, that the year-class 1923 was almost entirely wanting at Greenland. It will be seen, however, from the statistics given below (Table 73) that the Iceland fishery shows a fall in quantity just in 1932 (about 9 %), probably due to trading difficulties in the main; as the Icelanders have taken by far the most of the recaptured Cod, the reason may thus to some extent be the smaller fishery of the Ice-

landers in 1932. We also note however in the figures of the English fisheries statistics, that the catch per 100 hours fishing showed a great increase that year for the Cod. Consequently, there has been no lack of fish, but the migration to the spawning places at Iceland in 1932 may have taken place from other areas than West Greenland. It is doubtful therefore, how the fall in the number of emigrants in 1932 has to be understood, yet it seems clear at any rate, that the intensity of the emigration from Greenland to Iceland varies from year to year. The accompanying statistics indicate however very distinctly on the whole, that along with the strong emigration of Cod from Greenland to Iceland, the fishery at the latter has increased, both in absolute quantity and in catch per unit (e. g. 100 hours fishing, see Fig. 41).

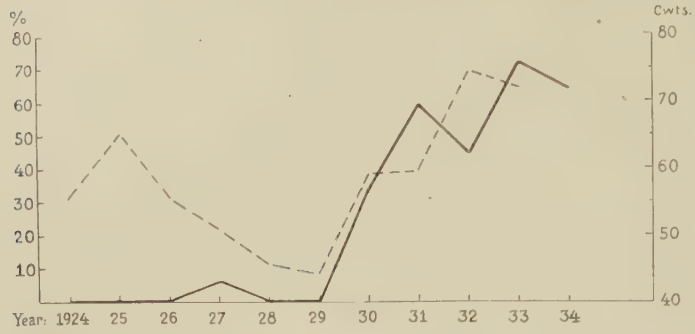

Fig. 41. ——— Percentage of emigrants to Iceland (the rest at Greenland).
------- Cwts. of Cod pr. 100 hours trawling at Iceland (English steam trawlers).

On the basis of the marking experiments we can say, that the emigration to Iceland has been of very great dimensions and may have included perhaps some hundred millions of Cod. The material to throw light on this question is not yet extensive enough to permit us to enter more closely on details, but we may just emphasize how very important it is to obtain continuous records of this emigration over a period of years; if our knowledge of its magnitude and fluctuations could be extended, the fishery naturally would reap the benefit.

Table 73. Statistical tables of Cod fishery at Greenland and Iceland 1920—33.

Year	Greenland. Product in tons[1])								Icelandic Grounds[1]) All Nations tons	Iceland[2]) tons		Iceland[3]) Average catch pr. 100 hours fishing ($^1/_{10}$ cwt.)
	Faroe Islands	Norway	Denmark	Germany	France	England	Scotland	Total		Large Cod	Codling	
1920	..	..	399	..	..	..	..	*399*	187.461	70.798	21.175	—
1921	..	..	414	..	..	..	..	*414*	175.884	77.933	22.768	—
1922	..	..	523	..	..	..	..	*523*	223.546	87.907	27.022	510
1923	..	..	681	..	..	..	..	*681*	222.719	86.203	32.008	386
1924	..	..	834	..	..	..	..	*834*	304.241	119.417	43.068	559
1925	..	?	856	..	..	..	352	*1.309*	324.728	126.618	50.082	654
1926	2.400	..	2.055	..	..	..	102	*4.557*	301.194	103.973	37.015	559
1927	2.799	..	3.291	..	..	..	315	*6.405*	343.078	127.083	56.008	513
1928	1.308	..	3.680	..	..	485	15	*5.488*	364.271	142.550	54.482	459
1929	10.245	..	5.634	49	2.745	945	328	*19.946*	398.812	167.318	56.097	444
1930	24.747	..	8.161	41	15.520	2.488	264	*51.221*	498.435	211.677	78.632	596
1931	20.905	71	7.530	..	27.146	2.648	283	*58.583*	483.402	165.165	84.283	597
1932	15.018	189	7.998	..	19.964	1.297	135	*44.601*	485.288	162.836	66.670	745
1933	18.038	?	7.171	?	?	?	?	?	?	179.707	74.430	722

[1]) International Statistics, Bulletin Statistique Vol. XI—XXII, 1924—1934. Portuguese, Canadian and Newfoundland catchcs not known. [2]) From "Fiskifélag Íslands". [3]) Sea Fisheries, Statistical Tables 1922—1933; English Steam Trawlers.

B. East Greenland.

In this general summary we may refer quite briefly to the marking experiments at Angmagssalik in East Greenland; the recaptures from these have been very few altogether (8 or about 1 %) and the extended migrations made by Cod from here follow quite the same lines as those mentioned for West Greenland.

The Table 74 gives a summary of all the marking experiments and recaptures in the years 1926 to 1934. The Chart Fig. 31, p. 62 shows the long migrations.

Table 74. Cod marking experiments at East Greenland.

Year	No. marked	Of resp. experiment recapt. at Greenland	Of resp. experiment recapt. at Iceland	Recap. Total	Year of recapt. at Greenland	Year of recapt. at Iceland	Recap. Total
1926	2	..	..	..	..	..	..
1927	100	..	2	2	..	..	..
1928	11	..	..	..	..	..	..
1929	..	..	..	..	..	..	..
1930	182	1	1	2	1	..	1
1931	243	1	..	1	1	2	3
1932	34	..	..	..	..	..	..
1933	200	..	3	3	..	1	1
1934	..	..	..	..	..	3	3
Total	772	2	6	8	2	6	8

The material has been discussed in more detail on pp. 60—63 and the data of the experiments will be found in Appendix A, pp. 114—115.

In general we may sum up the results from this area in the following words. The Cod marked at Angmagssalik emigrate to the spawning banks at Iceland on reaching maturity at a length of about 75—90 cm.; how far there may be a return migration, is not known. The migrating Cod may be met with in great quantities during the summer along the east coast of Greenland (Braarud & Ruud 1932, pp. 9—12) and it is possible, that among these occur some Cod of West Greenland origin as well as Iceland and East Greenland Cod. Spawning of Cod is so far unknown in the Angmagssalik district; consequently, the transference of the fry from Iceland, discovered in the years 1931—33 on the cruises of the "Dana", must be considered the principal means of maintaining the supply, which, however, is probably augmented by the emigration of larger Cod from Iceland, at a certain time of the year at any rate.

C. Concluding remarks and future work.

From the facts discussed in the foregoing, with regard to the emigration of Cod from Greenland to Iceland, we obtain the impression that this emigration may proceed on a very large scale indeed and yet shows very obvious fluctuations. The phenomenon is of such magnitude that one is hardly saying too much in maintaining, that for the moment the unravelling of all the conditions concerning it may be considered the most important question for the scientific fisheries investigations in the waters round Greenland and Iceland. The solution of quite a number of questions is also closely connected with these investigations on the Cod migrations in this area, and these can only achieve their purpose

through an all-round study of the biology of the Cod in the North Atlantic, including the hydrographical and other conditions.

The present marking experiments show clearly, how necessary it is to proceed with these continuously both in the Greenland and Iceland areas; stock analyses of the Cod must however go hand in hand with the experiments; and most important of all is the necessity of making continuous hydrographical investigations at Iceland as well as East and West Greenland. In the present work it has not been possible to examine more closely the hydrographical changes as cause or even one of the causes of the migrations, for the simple reason that the material for such a purpose is on the one hand very meagre and scattered, on the other not yet published; its inclusion must therefore wait till the next part of this work is published. The collection of continuous hydrographical data at both Greenland and Iceland has now begun and, it is hoped, will continue until we have been able to prove the influence of the hydrographical conditions on the migrations of the Cod, and thus on the fisheries. So far as the fisheries are concerned, it is of great importance to know, e. g. whether certain hydrographical conditions along the east coast of Greenland (extension of polar water, for example) occur periodically and thus determine whether the spent Cod at Iceland tend to travel towards Greenland or northwards round Iceland to the north and east coasts, where the fishery during the present period has been less than previously; this again seems in harmony with a greater fishing at West Greenland.

A closer study should also be made of the extent of the spawning at West Greenland, by comparison with that which occurs at Iceland. Connected with this there should be a continuation of the investigations on the drift of the fry from West Iceland to East Greenland; here it is of importance first of all to determine, whether the fry of the Cod carried to East Greenland reach to West Greenland via Cape Farewell, a point that has not yet been settled; possibly the fry are only carried as far as the southernmost of the West Greenland districts. The solution of these questions would undoubtedly mean a most important advance towards understanding the emigration of the mature Cod to Iceland. Racial studies of various kinds would certainly also prove necessary in this connection. Lastly, the unravelling of the precise route followed by the migrating Cod would be of importance for the future extension of the Cod fishery.

Even within the field of marking experiments several improvements are badly wanted. Although the particulars given of the recaptures have been greatly improved in the course of recent years by sending out schemes to be filled in and by posting up notices of the experiments, there is still much to be desired, especially with regard to precise statement of the place of capture, length of fish and collection of otoliths.

Summary.

1. During the years 1924—33 6811 specimens of Cod were marked especially in July—October in a great number of localities at West Greenland; 772 specimens were marked at East Greenland. Nearly all the Cod marked measured 50—115 cm.
2. Marked Cod are still being recaptured in the eight year after marking, which proves that the method followed during the marking was good.

3. Of the Cod marked at West Greenland 397 (or 5.2 %) were recaptured; at East Greenland 8 (or about 1 %); 197 of these Cod have migrated from West Greenland to Iceland and 6 from East Greenland to Iceland (see the Tables 43—45, pp. 64—65, Table 74, p. 89 and the different Charts).
4. The greater part of the Cod recaptured at Greenland have only migrated a short distance; there is however a tendency towards a northern migration of particularly large old Cod (e. g. to the Great Hellefisk Bank). Some of the Cod at West Greenland which have wandered southward seem to have commenced migration to Iceland.
5. Between the banks and the fjords and vice versa only a slight interchange of Cod of the sizes marked seems to have taken place (1924—34).
6. The Cod migrated to Iceland are mature individuals which undertake the wandering in order to spawn on the spawning places at West and South Iceland.
7. Very few Cod over about 100 cm seem to wander the long distance to Iceland. The majority belong to the sizes which undertake the most extensive migrations, i. e. specimens between 70 and 100 cm.
8. The emigration to Iceland is greatest from the most southern districts of West Greenland (especially great for the Cod marked in the Julianehaab District).
9. The emigration to Iceland is greatest for Cod marked in the coastal waters or on the banks at West Greenland, less for Cod marked in the fjords.
10. The percentage of recaptures is high during the first 3—4 years after marking, then it decreases rapidly (see Table 55, p. 75).
11. The migration to Iceland takes place in the late autumn and in the winter (between October and April). Marked Cod are therefore not taken at Iceland until the year after marking.
12. The recapture at South and West Iceland takes place especially during the spawning time March—May.
13. The emigration to Iceland did not rightly commence until the winter 1929—30 but increased rapidly in the years 1933—34. In 1933 e. g. 72 % of the Cod recaptured were retaken at Iceland against but 28 % at Greenland. The migration has thus been of very considerable dimensions.
14. Simultaneously with the considerable migration from Greenland to Iceland the product of the fisheries at Iceland has increased (e. g. per 100 hours trawling). See Fig. 41, p. 88.
15. The percentage of Cod migrating to Iceland in order to spawn seems to vary somewhat from year to year.
16. The emigrants to Iceland are especially 9—11 years old Cod (though some 6—8 years and a few 12 years or older emigrate too).
17. Moreover age analyses have shown that nearly all the migrating Cod belong to the predominant year-classes born in 1922 and 1924, these year-classes prevailing during recent years.
18. The rate of growth of Cod approaching maturity for the first time and migrating to Iceland seems to be decreasing.
19. The migration of Cod from East Greenland to Iceland takes place on the same lines as that of the stock from West Greenland.
20. It is recommended to continue the experiments in future by means of continuous markings at Greenland and Iceland together with continuous hydrographical and biological investigation of the waters in the area, as knowledge of the extensive interchange of Cod between Greenland and Iceland can be of decisive importance to the fishery at Greenland.

LITERATURE

Trygve Brårud and Johan T. Ruud: The "Øst" Expedition to the Denmark Strait 1929. I. Hydrography. Hvalrådets Skrifter. Nr. 4. Oslo. 1932.

Paul M. Hansen: Undersøgelser over den grønlandske Torsk. Beretninger og Kundgørelser vedr. Styrelsen af Grønland. No. 4. pp. 705—711, København. 1931.

Fiskeriundersøgelserne ved Vestgrønland i 1931. Beretninger og Kundgørelser vedr. Styrelsen af Grønland. No. 2. pp. 902—906. København. 1932.

— Fiskeriundersøgelser ved Vest-Grønland i 1932. Beretninger og Kundgørelser vedr. Styrelsen af Grønland. No. 1, pp. 32—43. København. 1933.

— a) Fiskeriundersøgelser ved Vest-Grønland i 1933. Beretninger og Kundgørelser vedr. Styrelsen af Grønland. No. 2, pp. 226—247. København. 1934.

— b) Synopsis of Investigations into Fluctuations in the Stock of Cod at Greenland during the years 1930—33. Rapp. et Procès-Verbaux. Vol. 86, pp. 1—11. København. 1934.

Ad. S. Jensen: On the Fishery of the Greenlanders. Medd. Komm. f. Havundersøgelser. Serie: Fiskeri, Bind VII. No. 7. København. 1925.

— Investigations of the "Dana" in West Greenland Waters, 1925. Report of the North-Western Area Committee for 1924 and 1925. Rapp. et Procès-Verbaux. Vol. 39, Copenhague. 1926.

Ad. S. Jensen and Paul M. Hansen: Undersøgelser over den grønlandske Torsk (*Gadus callarias* L.). Med en Indledning om de grønlandske Torskefiskeriers Historie. København. 1930.

— Investigations on the Greenland Cod (*Gadus callarias* L.). With an Introduction on the History of the Greenland Cod Fisheries. Rapp. et Procès-Verb. Vol. 72, pp. 1—37. Copenhague. 1931.

Thor Iversen: Some Observations on Cod in Northern Waters. (Fiskeridirektoratets Skrifter). Rep. Norw. Fishery and Marine Invest. Vol. IV. No. 8. Bergen. 1934.

Johs. Schmidt: Racial Investigations X. The Atlantic Cod (*Gadus callarias* L.) and local races of the same. Comptes-Rendus des Trav. du Laboratoire Carlsberg, 18, No. 6. Copenhague. 1930.

— a) Summary of the Danish Marking experiments on Cod, 1904—1929, at the Faroes, Iceland and Greenland. Rapp. et Proc.-Verb. 72 (III). Copenhague. 1931.

— b) Les nouvelles recherches sur les migrations de la morue dans le nord de l'Atlantique. La Pêche Maritime XIV, 1009—10, 11-X-1931. Paris.

— c) On the occurrence of the Cod (*Gadus callarias* L.) at East Greenland. Rapp. et Proc.-Verb. 72 (IV), Copenhague. 1931.

Å. Vedel Tåning: A Method for Marking Cod. Capt. Hansen's Marking Needle. Journal du Conseil. Vol. VIII, p. 385. Copenhague. 1933.

— Investigations on the Icelandic and Greenland Stock of Cod in 1932. Rapp. Procès-Verbaux. Vol. 85. III. pp. 7—8. Copenhague. 1933.

— a) Survey of Long Distance Migrations of Cod in the North Western Atlantic according to Marking Experiments. Rapp. et Procès-Verbaux. Vol. 89, III, 2. pp. 5—11. Copenhague. 1934.

— b) Göngur Þorsksins i Norður-Atlantshafi. Ægir, 27. Árg., 1. pp. 31—35. Reykjavík 1934.

— c) A supposed Submarine ridge along the South-East coast of Greenland. Nature. Vol. 133, p. 326. London. 1934.

Appendix A.

Detailed particulars of liberation and recapture.

Abbreviations etc.

G 1, **G 2** etc. = number of marking experiments in Greenland waters (see Chart Fig. 2, p. 7).
(b) marked on offshore banks.
(c) — in coastal waters.
(f) — in the fjords.

Nationality of fishing vessel: C = Canadian, D = Danish, E = English, F = Faroese, Fr = French, G = German, Gr = Greenland, I = Iceland, N = Norwegian, Nf = Newfoundland, P = Portuguese; ? = unknown nationality.

Emphasized number of fish = fish retaken in Iceland waters.
c. Position not given directly by fishermen.
c. in front of depth: fathoms converted to metres.

Age is given as age-group and year-class. Sections of otoliths have been used in all cases where not otherwise stated.

n or *s* after length of migration indicates north or south migration more than 20 miles.

Distance migrated to Iceland: though route is supposed to go along east coast of Greenland north to abt. Angmagssalik, we have in all calculations reckoned with the straight distance from Cape Farewell to Iceland.

Liberation

Exp. No.		Locality	Position Lat. N.	Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
1924	**G 1** (b)	Fylla Bank	63°55′	52°44′	$^{24}/_{6}$ 24	8	1-8	7	Off Greenland
(414)[1])	**G 2** (c)	Godthaab Fjord (Kangek)	64°07′	52°03′	$^{1-2}/_{7}$ 24	75	9-84	15	Off Godthaab
								44	2 miles off Buksefjor
								61	Off Igarissat Isls., God Fjord
	G 2 (c)	Godthaab Fjord (Kangek)	64°07′	52°03′	$^{30}/_{7}$ 24	49	85-133	86	Off Kangek, Godth.
								103	Kornok, Godthaab F
								116	Off Kangek
	G 3 (c)	Sukkertoppen	65°23′	52°42′	$^{12}/_{8}$ 24	9	134-142	135	Off Ikerasak
								138	Off Sukkertoppen
	G 4 (c)	Amarkok	65°30′	52°57′	$^{15}/_{8}$ 24	14	143-156	147	Off Ikerasak
	G 5 (c)	Off Sukkertoppen	65°24′	52°48′	$^{17}/_{8}$ 24	28	157-184		
	G 6 (c)	Off Kin of Sal.	65°26′	53°00′	$^{22}/_{8}$ 24	78	185-264		
	G 6 (c)	Off Kin of Sal.	65°26′	53°00′	$^{25}/_{8}$ 24	78	265-341	271	c. 800 m E. of Su toppen
								339	Off Hamborgerland
	G 6 (c)	Off Kin of Sal.	65°24′	52°54′	$^{27}/_{8}$ 24	60	342-401	**342**	Brede Bay, Iceland
								343	SW. of Fylla Bank
								346	Off Agpamiut
								385	West Iceland
	G 6 (c)	Off Kin of Sal.	c.65°24′	52°48′	$^{2}/_{9}$ 24	15	402-416		
1925	**G 7** (b)	Fylla Bank	63°56′	52°41′	$^{4}/_{7}$ 25	28	2501-2528	2502	Fylla Bank
(410)								2516	SE.-edge of Fylla Ba
								2518	Fylla Bank
								2528	Fylla Bank
	G 8 (b)	Fylla Bank	64°11′	52°47′	$^{5}/_{7}$ 25	77	2529-2605	2538	Fylla Bank
								2539	Fylla Bank
								2583	Fylla Bank
								2593	Fylla Bank
								2596	E. of Sukkertoppen
								2603	Off Hjortetakken
	G 9 (b)	Fylla Bank	63°36′	52°34′	$^{6}/_{7}$ 25	75	2606-2650,	2607	Off Kangamiut
							536-549,	2613	Fylla Bank
							712, 729,	2616	South-end of Fylla
							736, 744,	2617	South-end of Fylla
							760, 768,	2618	Fylla Bank
							773-778,	2621	Fylla Bank
							1536-1539	2622	Fylla Bank
								2629	Fylla Bank
								2636	Fylla Bank
								2649	Fylla Bank
								2650	South-end of Fylla
								545	Fylla Bank
								760	Fylla Bank
								768	Fylla Bank
								778	Fylla Bank
								1538	South-end of Fylla
	G 10 (b)	Dana Bank	62°37′	51°02′	$^{11}/_{7}$ 25	60	1540-1599	1571	Off Kangamiut
								1589	Dana Bank

[1]) Total number marked.

reenland

Recovery

epth in netres	Position (approximately) Lat. N.	Long W	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
?	?	?	15/7 29	60 2/3	?	?	86—?		Fr.	7
c. 85	c. 64°07′	51°53′	June 27	c. 35	<10	?	111—114.5		Gr.	15
?	c. 63°47′	51°33′	11/8 27	37 1/3	24 s	♀	75—87	X, 1917	F.	44
?	c. 64°07′	51°50′	16/9 24	2 1/2	<10	?	115—?		Gr.	61
c. 53	c. 64°06′	52°02′	5/12 29	64	<10	?	103—?		Gr.	86
?	c. 64°33′	51°04′	c. 15/8 26	24 1/2	35 n	?	75—?		Gr.	103
c. 28	c. 64°06′	52°02′	28/7 27	36	<10	?	76—?		Gr.	116
?	c. 65°10′	52°25′	25/6 27	34 1/2	20 s	?	62—81.5		Gr.	135
?	c. 65°24.5′	52°53′	7/10 26	25 3/4	<10	?	75—88		Gr.	138
20	c. 65°10′	52°25′	12/6 28	46	30 s	♀	48—80		Gr.	147
. 113	c. 65°24.5′	52°52′	Summer 27	c. 35	<10	?	94—107		Gr.	271
?	65°30′	53°45′	Summer 31	c. 84	18	?	80—101		F.	339
?	c. 65°10′	24°00′	5/5 32	92	1080	?	56—95.5		F.	**342**
?	c. 63°35′	52°40′	21/7 26	23	100 s	?	54—75		Fr.	343
?	c. 65°38′	53°17′	25/7 26	23	18	?	76—?		Gr.	346
?	64°18′	23°08′	23/3 27	31	1050	?	70—78		I.	**385**
?	63°49′	52°38′	11/7 25	1/4	<10	?	98—99		N.	2502
?	c. 64°00′	52°30′	24/7 25	2/3	<10	?	109—?		N.	2516
?	63°49′	52°38′	9/7 25	<1/4	<10	?	89—?		N.	2518
?	c. 63°49′	52°38′	1925	?	<10	?	103—104		N.	2528
?	c. 63°49′	52°38′	22/7 25	1/2	22 s	?	107—?		N.	2538
c. 56	64°04′	52°53′	29/6 28	35 3/4	<10	♂	87—96	XI, 1917	F.	2539
?	c. 63°49′	52°38′	10/7 25	<1/4	22 s	?	94—94		N.	2583
?	c. 63°49′	52°38′	9/7 25	<1/4	22 s	?	87—88		N.	2593
c. 28	c. 65°22′	52°27′	9/5 29	46	70 n	?	78—?		Gr.	2596
c. 45	c. 64°04′	52°33′	26/6 26	11 3/4	<20	♂	98—99	XIII, 1913	F.	2603
c. 28	c. 65°48′	53°25′	2/7 31	71 3/4	135 n	♀	99—110		Gr.	2607
?	63°41′	52°38′	27/7 26	12 3/4	<10	?	96—100		N.	2613
?	63°37′	52°28′	13/8 27	25	<10	?	114—117		F.	2616
?	c. 63°37′	52°28′	c. 15/7 26	12	<10	?	87—?		N.	2617
?	63°39′	52°36′	28/7 26	12 2/3	<10	?	105—110		N.	2618
c. 45	c. 63°50′	52°30′	20/7 25	1/2	15	?	98—99	XIII, 1912	F.	2621
c. 66	c. 63°38′	52°45′	12/7 27	24	<10	♂	97—?	XII, 1915	F.	2622
?	c. 63°49′	52°38′	c. 8/7 25	<1/4	14	?	114—?		N.	2629
?	c. 63°49′	52°38′	c. 8/7 25	<1/4	14	?	113—?		N.	2636
. 104	63°57′	52°21′	25/6 28	35 2/3	20 n	♀	89—97	XII?, 1916?	F.	2649
?	c. 63°37′	52°28′	c. 15/7 26	12	<10	?	104—?		N.	2650
?	c. 63°49′	52°38′	1925	?	14	?	109—?		N.	545
?	63°41′	52°38′	27/7 26	12 3/4	<10	?	94—98		N.	760
?	63°39′	52°36′	28/7 26	12 3/4	<10	?	107—112		N.	768
?	63°38′	52°20′	28/7 25	3/4	<10	?	107—?		N.	778
?	c. 63°33′	52°07′	c. 15/7 26	12	<10	?	116—?		N.	1538
?	c. 65°52′	53°13′	27/7 33	96 1/2	210 n	?	100—130		Gr.	1571
?	c. 62°37′	51°02′	Summer 30	c. 60	0	?	81—?		F.	1589

Liberation

Exp. No.	Locality	Position Lat. N.	Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
G 11 (b)	Little Hellefisk Bank	64°25′	53°24′	$^{13}/_{7}$ 25	51	1600, 2901-2950	2901	Fylla Bank .....
							2905	Off Holstensborg .....
							2921	Between Great and L Hellefisk Bank .....
							2934	Little Hellefisk Bank .
							2943	Davis Strait.....
							2944	Off Holstensborg.....
G 12 (c)	W. of Sukkertoppen.....	65°24′	53°05′	$^{30}/_{7}$-$^{6}/_{8}$ 25	61	2951-3012	2961	Off Agpamiut .....
							2974	SW. of Simiutak.....
							2984	Isortok .....
							2986	Off Angmasivik.....
							2990	Off Ikerassak.....
							3007	Off Ikerassak.....
G 13 (c)	W. of Hamborgerland	65°35′	53°20′	$^{9\text{-}17}/_{8}$ 25	52	3013-3065	3033	?
G 12 (c)	W. of Sukkertoppen.....	65°24′	53°05′	$^{20}/_{8}$ 25	6	3066-3071		
1926 G 14 (b)	Off Holstensborg.....	66°50′	54°10′	$^{16\text{-}20}/_{7}$ 26	26	779-805	799	1 mile from Sarfanguak
(342) G 50 (f)	Fiskenæsset	63°03′	50°48′	June 26	2	3101-3102		
G 15 (f)	Kapisigdlit.....	64°23′	50°25′	$^{25\text{-}28}/_{6}$ 26	23	3103-3125[1])	3109	Off Kagssinguit Godth District.....
							3111	Kapisigdlit.....
							3116	Vikuráll, Patreksfjord, land.....
G 16 (f)	Kugssuk.....	64°40′	51°15′	$^{1\text{-}3}/_{7}$ 26	16	3126-3138, 3141-3143		
G 18 (f)	Amituarsuk	64°32′	50°35′	$^{5}/_{7}$ 26	4	3144-3147		
G 19 (f)	Korkut	64°13′	51°30′	$^{8}/_{7}$ 26	39	3148-3185, 3187		
G 20 (b)	Fylla Bank	64°02′	52°25′	$^{27}/_{7}$ 26	13	3186, 3188-3199		
G 21 (b)	Fylla Bank	63°59′	53°03′	$^{28}/_{7}$ 26	21	4801-4821		
G 22 (b)	Fylla Bank	64°01′	52°36′	$^{30}/_{7}$ 26	49	4822-4870	4856	Off Siglufjord, Iceland
G 23 (f)	Ikamiuts Kangerdluarssuk	65°37′	52°48′	$^{3}/_{8}$ 26	50	4871-4920		
G 24 (c)	Atangmik.....	64°48′	52°10′	$^{7}/_{8}$ 26	4	4921-4924		
G 25 (f)	Angmasivik	64°52′	51°55′	$^{8}/_{8}$ 26	46	4925-4970	4963	Off Angmasivik.....
G 17 (f)	Kornok.....	64°33′	51°04′	$^{25\text{-}26}/_{8}$ 26	47	3139-3140, 4971-5015	4990	Kornok.....
							4997	Kornok.....
G 18 (f)	Amituarsuk	64°32′	50°35′	$^{27}/_{8}$ 26	2	5016-5017		
1927 G 27 (f)	Oriok in Ikertokfjord.....	66°49′	52°21′	$^{25}/_{5}$ 27	80	5018-5093,	5018	6-7 miles from Oriok .
(201)						5101-5104[2])	5045	Off Oriok .....
							5060	Off Oriok .....
							5063	Off Oriok .....
							5066	Off Amerdlok, Holstens
							5081	Off Oriok .....
							5082	Off Oriok .....
							5101	Off Oriok .....
G 28 (c)	Frederikshaab	62°00′	49°45′	$^{22\text{-}23}/_{7}$ 27	95	5105-5150, 5351-5399	5134	Off Nanortalik, Julian haab District.....

[1]) 15 specimens taken with net. [2]) All cod from this marking experiment were caught in net.

eenland

Recovery

pth in etres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
?	c. 63°41′	52°38′	c. $^{15}/_{7}$ 25	$<^{1}/_{4}$	45 s	?	111—?		N.	2901
c. 15	c. 66°55′	53°47′	$^{29}/_{9}$ 31	$74^{1}/_{2}$	150 n	?	96—118		Gr.	2905
c. 85	66°04′	54°24′	$^{4}/_{8}$ 30	$60^{2}/_{3}$	100 n	?	95—104		F.	2921
c. 56	64°25′	53°40′	$^{15}/_{7}$ 25	$<^{1}/_{4}$	<10	?	96—?		N.	2934
?	?	?	$^{21}/_{7}$ 25	$^{1}/_{4}$	?	?	80—82		N.	2943
c. 56	c. 66°55′	53°37′	c. $^{18}/_{7}$ 30	60	150 n	?	112—?		Gr.	2944
?	c. 65°38′	53°17′	$^{17}/_{9}$ 29	$49^{1}/_{2}$	15	♂	77—103		Gr.	2961
?	c. 65°53′	53°54′	$^{9}/_{7}$ 31	$71^{1}/_{3}$	36 n	♀	74—?	XII, 1919	F.	2974
?	c. 65°20′	52°30′	$^{29}/_{4}$ 29	45	17	?	84—?		Gr.	2984
?	c. 64°50′	52°00′	$^{24}/_{6}$ 26	$10^{3}/_{4}$	50 s	?	80—?		Gr.	2986
?	c. 65°10′	52°13′	$^{10}/_{6}$ 26	$10^{1}/_{4}$	20 s	?	76—?		Gr.	2990
?	c. 65°10′	52°13′	$^{19}/_{6}$ 26	$10^{1}/_{2}$	20 s	?	90—?		Gr.	3007
?	?	?	1932	c. 80	?	?	80—?		Gr.	3033
?	c. 66°52′	52°52′	$^{9}/_{7}$ 31	$59^{1}/_{2}$	35 n	?	103—119		Gr.	799
c. 33	c. 64°31′	50°30′	$^{3}/_{11}$ 26	$4^{1}/_{4}$	<10	?	80—83		Gr.	3109
?	c. 64°23′	50°25′	May 27	c. 11	0	?	75—?		Gr.	3111
?	c. 65°37′	24°08′	$^{8}/_{5}$ 30	$46^{1}/_{2}$	1050	?	55—87		I.	**3116**
. 282	c. 66°24′	19°03′	$^{1}/_{5}$ 31	57	1140	♀	58—81		I.	**4856**
?	c. 64°52′	51°55′	$^{9}/_{7}$ 27	11	0	?	61—68		Gr.	4963
c. 19	c. 64°33′	51°04′	$^{9}/_{10}$ 30	$49^{1}/_{2}$	0	?	55—70		Gr.	4990
?	c. 64°33′	51°04′	Summer 27	c. 11	0	?	55—?		Gr.	4997
c. 75	c. 66°52′	52°33′	$^{28}/_{7}$ 27	2	<10	?	68—?		Gr.	5018
c. 15	c. 66°49′	52°21′	$^{3}/_{6}$ 27	$^{1}/_{4}$	0	?	77—?		Gr.	5045
c. 9	c. 66°49′	52°21′	$^{3}/_{6}$ 27	$^{1}/_{4}$	0	?	90—90		Gr.	5060
c. 6	c. 66°49′	52°21′	$^{8}/_{6}$ 27	$^{1}/_{2}$	0	?	74—74		Gr.	5063
c. 28	c. 66°52′	52°52′	$^{5}/_{7}$ 34	85	<20	♂	80—111	XV—XVII?, 1919—17?	Gr.	5066
c. 17	c. 66°49′	52°21′	$^{13}/_{5}$ 28	$11^{1}/_{2}$	0	?	69—77		Gr.	5081
c. 56	c. 66°49′	52°21′	$^{29}/_{10}$ 27	5	0	?	69—?		Gr.	5082
c. 47	c. 66°49′	52°21′	$^{31}/_{7}$ 27	2	0	?	73—?		Gr.	5101
?	c. 60°07′	45°15′	May 1930	c. 34	168 s	?	109—?		Gr.	5134

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							5148	Off Kagssit Isls., Holste
							5363	Off Narsak, Godthaab strict
G 15 (f)	Kapisigdlit	64°23′	50°25′	$^{14}/_{9}$ 27	26	5400-5425	5404	Kapisigdlit
1928 G 29 (b) (109)	Little Hellefisk Bank	64°53′	53°18′	$^{3}/_{10}$ 28	106	807-929	**858**	W. of Hrisey, Eyjafj Iceland
							864	Off Ønundarfjord, Icela
							870	Isafjord Deep, Iceland.
							886	Rødehuk Ground, Icela
G 30 (b)	Julianehaab Bank	60°16′	47°48′	$^{10}/_{10}$ 28	3	930-932		
1929 G 31 (c) (500)	Off Julianehaab	60°42′	46°02′	$^{22\text{-}24}/_{8}$ 29	119	7651-7769	**7666**	Off Cape North, Icelan
							7673	N. of Akulerusak
							7743	Off Siglufjord, Iceland.
G 32 (f)	Anordluitsok	60°03′	44°12′	$^{6}/_{9}$ 29	5	7770-7774		
G 33 (f)	Kangikitsok	60°12′	44°07′	$^{7\text{-}13}/_{9}$ 29	54	7775-7828	**7794**	Off Siglufjord, Iceland
							7799	Off Kangamiut
							7803	Kornok, Godthaab Fjor
G 34 (c)	Torsukatak	59°59′	44°30′	$^{16}/_{9}$ 29	10	7829-7838	**7829**	Off Akranes, Iceland
G 35 (c)	Nanortalik	60°07′	45°18′	$^{18\text{-}20}/_{9}$ 29	62	7839-7900	7869	Off Nanortalik
							7875	Off Nanortalik Isl.
							7893	Off Nanortalik Isl.
							7897	Off Nanortalik Isl.
G 36 (f)	Unartok Fjord	60°34′	45°15′	$^{3}/_{10}$ 29	44	7901-7944	**7901**	Off Selvogsbanki, Icelan
							7903	Off Sandgerdi, Iceland.
							7906	Isafjord Deep, Iceland.
							7923	Off Brimnes, Iceland.
							7925	Off Tasermiutfjord
							7938	Off Sletten
G 37 y[1] (f)	Agdluitsokfjord	60°29′	45°30′	$^{3}/_{10}$ 29	11	7945-7955		
G 37 x (c)	Off Sydprøven	60°27′	45°34′	$^{5}/_{10}$ 29	120	7956-8075	7974	Akulierusek
							7978	Off Sydprøven
							7982	Off Nanortalik Isl.
							7994	Jökulfjord, Iceland
							7996	Off Grindavik, Iceland.
							7997	Off Bardi, Iceland
							8005	South-Iceland
							8014	Off Isafjord Deep, Icel
							8045	NW. of Sydprøven
							8057	Off Sydprøven
							8058	Off Hornbjarg, Iceland
							8060	NE. of Cape North, Icel
							8069	E. of Ujaragtorfik
							8075	S. of Ujaragtorfik
G 38 y[2] (f)	Ikek at Sangmissok	59°58′	43°56′	$^{10\text{-}11}/_{10}$ 29	75	8076-8150	**8090**	Eyjafjord, Iceland
							8115	39 miles E. by N. of H Iceland
							8139	20 miles NW. of Ba Iceland

[1]) 37 x and y rather close to each other; in Index Chart Fig. 2 p. 7 given as one. [2]) 38 x and y: see footnote [1]).

reenland

Recovery

epth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
c. 38	c. 66°58′	54°06′	$^{18}/_{8}$ 30	37	325 n	♀	67—96		Gr.	5148
c. 79	c. 63°59.5′	51°38′	1928	?	130 n	?	64—?		Gr.	5363
?	c. 64°23′	50°25′	$^{2}/_{6}$ 28	$8^{1}/_{2}$	0	?	88—90		Gr.	5404
?	66°03′	18°25′	$^{15}/_{5}$ 31	$31^{1}/_{3}$	1145	?	81—?		I.	**858**
c. 75	c. 66°10′	24°12′	$^{30}/_{4}$ 31	31	1050	?	85—100		I.	**864**
?	c. 66°13′	23°13′	$^{5}/_{4}$ 30	18	1080	♀	77—86		I.	**870**
c. 122	66°49′	16°15′	$^{22}/_{6}$ 31	$32^{2}/_{3}$	1260	?	79—88.4		F.	**886**
c. 150	c. 66°50′	23°10′	$^{9}/_{6}$ 31	$21^{1}/_{2}$	760	♂	58—63.5	IX?, 1922?	I.	**7666**
80	c. 60°29′	45°29′	$^{21}/_{11}$ 29	2	20 s	?	87—?		Gr.	7673
140-150	c. 66°28′	19°38′	$^{15}/_{5}$ 30	$8^{2}/_{3}$	860	♂	82—84		I.	**7743**
?	c. 66°28′	19°38′	$^{30}/_{4}$ 33	$43^{1}/_{2}$	705	♀	53—76	IX, 1924	I.	**7794**
c. 75	66°17′	54°33′	$^{14}/_{7}$ 34	58	500 n	♂	69—86.5	XII, 1922	F.	7799
c. 19	c. 64°34′	51°03′	$^{23}/_{5}$ 30	$8^{1}/_{2}$	300 n	?	117—?		Gr.	7803
c. 44	c. 64°16′	22°16′	$^{20}/_{7}$ 32	34	700	?	68—?		E.	**7829**
c. 23	c. 60°07′	45°18′	$^{6}/_{8}$ 31	$22^{1}/_{2}$	0	?	58—?		Gr.	7869
c. 30	c. 60°09′	45°13′	$^{25}/_{1}$ 32	28	<10	?	76—85		Gr.	7875
c. 38	c. 60°10′	45°12′	$^{9}/_{8}$ 30	$10^{2}/_{3}$	<10	?	77—82		Gr.	7893
c. 30	c. 60°10′	45°12′	$^{12}/_{8}$ 30	$10^{3}/_{4}$	<10	?	80—87		Gr.	7897
72	c. 63°47′	21°47′	$^{23}/_{4}$ 32	$30^{2}/_{3}$	750	♀	62—68.5	VIII, 1924	I.	**7901**
c. 113	c. 64°02′	23°30′	$^{24}/_{4}$ 31	$18^{2}/_{3}$	720	♀	77—80	VIII, 1923	I.	**7903**
c. 143	c. 66°11′	23°02′	$^{26}/_{5}$ 30	$7^{3}/_{4}$	780	♂	74—?	VIII, 1922	I.	**7906**
200	65°23′	12°42′	$^{22}/_{7}$ 32	$33^{2}/_{3}$	1090	♂	55—91		I.	**7923**
c. 56	c. 60°04′	45°10′	$^{20}/_{3}$ 31	$17^{1}/_{2}$	30 s	?	61—?		Gr.	7925
c. 34	c. 60°37′	45°15′	$^{17}/_{10}$ 32	$36^{1}/_{2}$	18	?	71—85		Gr.	7938
20	c. 60°28′	45°29′	$^{6}/_{5}$ 32	31	<10	?	54—67		Gr.	7974
40	c. 60°28′	45°30′	$^{11}/_{7}$ 32	33	<10	?	78—90		Gr.	7978
c. 28	c. 60°10′	45°12′	$^{16}/_{8}$ 30	$10^{1}/_{3}$	25 s	?	118—?		Gr.	7982
?	c. 66°17′	22°55′	$^{2}/_{7}$ 30	9	750	?	85—?		I.	**7994**
c. 94	c. 63°46′	22°30′	$^{17}/_{4}$ 31	$18^{1}/_{2}$	740	♀	65—70	IX, 1922	I.	**7996**
c. 75	c. 66°05′	24°20′	$^{31}/_{5}$ 30	8	720	♂	66—66		I.	**7997**
c. 122	63°19′	20°40′	$^{17}/_{4}$ 31	$18^{1}/_{2}$	760	♂	83—?		F.	**8005**
?	c. 66°20′	23°44′	$^{13}/_{3}$ 34	$53^{1}/_{3}$	720	?	70—82	X, 1924	I.	**8014**
60	c. 60°27′	45°33′	$^{22}/_{11}$ 29	$1^{2}/_{3}$	0	?	114—?		Gr.	8045
40	c. 60°28′	45°30′	$^{19}/_{7}$ 32	$33^{1}/_{2}$	<10	?	66—78		Gr.	8057
145	c. 66°50′	22°40′	$^{2}/_{6}$ 31	20	780	♀	68—71	IX, 1922	I.	**8058**
c. 141	c. 66°53′	22°10′	$^{10}/_{6}$ 30	8	820	♂	70—70.4		I.	**8060**
140	c. 60°28′	45°30′	$^{5}/_{12}$ 29	2	<10	?	98—?		Gr.	8069
56	c. 60°28′	45°30′	$^{5}/_{12}$ 29	2	<10	?	121—?		Gr.	8075
?	c. 66°10′	18°30′	$^{21}/_{4}$ 31	$18^{1}/_{3}$	800	♀	73—76		I.	**8090**
c. 263	c. 66°55′	21°20′	$^{26}/_{5}$ 31	$19^{1}/_{2}$	750	♂	79—?		I.	**8115**
?	c. 66°06′	24°38′	$^{29}/_{3}$ 33	$41^{2}/_{3}$	700	?	73—82	XI, 1922	I.	**8139**

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
1930 G 39 (c) (1454)	Sermersek, N. of Sardlok, Julianehaab	60°35′	46°00′	$^{25}/_{6}$ 30	14	8151-8164	8157	Off Sardlok, Julianehaab
							8159	Off Grindavik, Iceland
G 40 (f)	Tasermiutfjord	60°11′	44°55′	$^{30}/_{6}$ 30	136	8165-8300	**8175**	Off Westmanna Isls., Ice land
							8199	Off Lóndrangar, Faxe Ba Iceland
							8213	Off Øgurnes, Isafjord Dee Iceland
							8245	Tasermiutfjord
							8266	Off Igdlokasik
							8270	Nanortalik
G 35 (c)	Nanortalik	60°10′	45°15′	$^{2}/_{7}$ 30	30	8301-8330	**8302**	Selvogsbanki, Iceland
							8305	Patreksfjord, Iceland
							8306	N. of Augpilagtok
							8314	Off Mánár Isl., Iceland
							8324	Off Akranes, Iceland
							8325	Off Akranes, Iceland
G 31 (c)	Off Julianehaab	60°42′	46°05′	$^{9\text{-}10}/_{7}$ 30	37	8331-8367	**8334**	Off Bolungarvik, Iceland
							8335	Off Anordluitsok
							8342	Off Skagafjord, Iceland
							8353	Off Augpilagtok
G 31 (c)	Akia off Julianehaab	60°42′	46°05′	$^{11}/_{7}$ 30	83	8368-8450	**8368**	Off Akranes, Iceland
							8373	Off Ritur, Isafjord, Icela
							8375	S. of Kagssimiut
							8382	Off Skagi, Faxe Bay, I land
							8414	Selvogsbanki, Iceland
							8425	Isafjord Deep, Iceland
							8432	Off Kielsens Næs, Julian
							8435	Off Siglufjord, Iceland
							8448	24 miles NW. of Akran Iceland
							8450	Vopnafjord, Iceland
G 41 (f)	Igalikofjord	60°59′	45°25′	$^{28}/_{7}$ 30	18	8451-8468	**8451**	Off Raudagnupr, Iceland
							8459	Off Malarif, Iceland
G 42 (f)	Tunugdliarfikfjord	61°08′	45°30′	$^{4}/_{8}$ 30	14	8469-8482		
G 43 (f)	Narsak, Julianeh. District.	60°55′	46°05′	$^{6\text{-}9}/_{8}$ 30	41	8483-8523		
G 44 (f)	Tartok N. of Julianehaab	60°49′	45°55′	$^{13}/_{8}$ 30	163	8524-8686	**8524**	Off Snæfellsjøkull, Icelan
							8549	Off Sletten
							8557	Off Narsak
							8580	Off Sandanes, Siglufjo Iceland
							8591	30 miles NW. of Reykjav Iceland
							8592	Off Julianehaab
							8613	Off Sydprøven
							8616	10 miles NW. of Gardska Iceland

reenland

Recovery

Depth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
62	c. 60°33′	46°02′	17/7 30	2/3	<10	♂	72 –?		Gr.	8157
?	c. 63°46′	22°30′	30/4 31	10	750	♂	72—?	IX, 1922	I.	**8159**
c. 146	c. 63°26′	20°51′	31/3 32	21	780	♂	62—70	VIII, 1924	G.	**8175**
80	c. 64°38′	23°40′	3/5 31	10	690	♂	74—75	IX, 1922	I.	**8199**
?	c. 66°04′	22°46′	15/7 32	24½	800	?	53—?		I.	**8213**
c. 38	c. 60°04′	45°10′	26/7 31	12¾	<10	?	59—?		Gr.	8245
c. 19	c. 60°00′	44°54′	9/6 33	35¼	15	?	71—78		Gr.	8266
c. 11	c. 60°10′	45°12′	1/7 31	12	<10	?	66—73		Gr.	8270
c. 113	c. 63°30′	21°50′	21/4 31	9⅔	705	?	72—?		I.	**8302**
?	c. 65°37′	24°10′	18/5 31	10½	690	♀	66—69	IX, 1922	I.	**8305**
c. 19	c. 60°09′	44°13′	11/8 33	37	35 s	?	77—85		Gr.	8306
?	c. 66°17′	17°10′	27/8 34	50	900	?	61—79		I.	**8314**
c. 85	c. 64°27′	22°52′	11/4 34	45⅓	690	♀	59—69.5	X?, 1924?	I.	**8324**
90-100	c. 64°20′	22°59′	7/3 34	44	690	♀	51—70	IX, 1925	I.	**8325**
c. 122	c. 66°10′	23°13′	15/3 32	20	800	♀	60—68		I.	**8334**
c. 56	c. 60°06′	44°13′	12/9 33	38	90 s	?	58—75		Gr.	8335
?	66°44′	19°36′	17/6 34	47	840	?	67—81		N.	**8342**
c. 96	c. 60°07′	44°17′	27/10 30	3½	85 s	?	90—?		Gr.	8353
c. 132	c. 64°35′	23°00′	14/5 33	34	720	♀	80—88	IX, 1924	I.	**8368**
c. 75	c. 66°22′	23°20′	19/5 31	10¼	750	?	78—?	IX, 1922	I.	**8373**
c. 38	c. 60°46′	47°08′	c. 30/9 30	c. 2	35 n	?	93—?		Gr.	8375
c. 73	64°10′	23°00′	4/5 32	21¾	685	?	64—?		E.	**8382**
c. 188	c. 63°30′	22°10′	30/4 31	9⅔	740	?	88—91		F.	**8414**
?	c. 66°15′	23°20′	11/4 31	9	740	?	68—?		I.	**8425**
c. 100	c. 60°42′	46°02′	18/9 30	2¼	0	?	91—?		Gr.	8432
c. 225	c. 66°18′	18°47′	3/4 32	20¾	860	♂	80—?	X, 1922	I.	**8435**
c. 122	c. 64°23′	23°00′	24/2 33	31½	790	♀	68—75	IX, 1924	I.	**8448**
?	c. 65°47′	14°40′	10/6 33	35	1080	?	67—84		I.	**8450**
?	66°46′	16°41′	16/8 33	36⅔	900	♀	80—91		F.	**8451**
100	64°44′	24°08′	19/5 31	9⅔	740	♂	69—70	VII, 1924	I.	**8459**
?	c. 64°30′	24°20′	9/3 34	43	680	?	59—73.3	VIII, 1926	E.	**8524**
c. 13	c. 60°37′	45°15′	20/8 32	24	45 s	?	66—74		Gr.	8549
c. 40	c. 60°56′	46°05′	2/6 34	45½	30 n	♀	63—70	VIII—XII?, 1926—1922?	Gr.	8557
?	66°13′	18°55′	6/6 34	44	890	♀	54—69	VIII, 1926	I.	**8580**
?	c. 64°15′	23°06′	8/3 33	31	720	♂	62—73	IX, 1924	I.	**8591**
27	c. 60°42′	46°02′	25/6 32	22½	< 10	?	88—97		Gr.	8592
c. 28	c. 60°27′	45°32′	7/7 31	10¾	24 s	?	64 –67		Gr.	8613
?	c. 64°08′	23°06′	8/3 34	43	710	?	66—?		I.	**8616**

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							8622	Off Westmanna Isls., Ic land
							8656	Off Krisuvikrberg, Icelan
							8660	Off Julianehaab
							8663	20 miles NW. of Akran Iceland
							8669	Off Sletten
							8675	Isafjord Deep, Iceland
G 31 (c)	Off Julianehaab	60°42′	46°05′	$^{14\text{-}15}/_{8}$ 30	64	8687-8750	**8693**	Off Snæfellsnes, Iceland
							8745	Iceland
							8746	Off Nanortalik
G 31 (c)	Arpatsivik	60°43.5′	45°54′	$^{20}/_{8}$ 30	100	8751-8800, 7601-7650	8765	Off Kagssimiut
							8777	Djupáll, NW. Iceland
							8795	Off Hvidenæs, Julianeha
							7606	Off Julianehaab
							7617	Off Ritur, Iceland
							7627	Off Cape North, Icelan
							7636	Off Grindavik, Iceland
							7638	Off Gardskagi, Iceland
							7644	N. of Snæfellsnes, Icelan
G 45 (c)	Kagssimiut, Julianehaab District	60°47′	47°10′	$^{26}/_{8}$ 30	100	8801-8900	8812	N. of Narsak
							8814	Off Akranes, Iceland
							8817	Off Reykjanes, Iceland
							8838	Selvogsbanki, Iceland
							8844	Hunaflói, Iceland
							8850	Off Langanes, Iceland
							8865	Off Einarsdrangr, Iceland
							8871	Off Arsuk
							8875	Faxe Bay, Iceland
							8879	Off Tasermiutfjord
							8883	Off Snæfellsnes, Iceland
							8885	Iceland
							8888	Off Sardlok
							8889	Off Akranes, Iceland
							8893	Iceland
							8896	NE. of Cape North, Icela
G 46 (c)	Arsuk, Frederikshaab District	61°10′	48°30′	$^{3}/_{9}$ 30	100	8901-9000	**8917**	Off Siglunes, Iceland
							8933	Off Øndverdarnes, Icelan
							8962	Off Utskálar, Iceland
							8991	Off Tvisker, Ingolfshøf Iceland
G 47 (f)	Off Neria	61°38′	49°00′	$^{6\text{-}8}/_{9}$ 30	100	9001-9100	**9002**	Off Westmanna Isls., I land
							9004	Off Gardskagi, Iceland
							9013	Off Kangek
							9023	?
							9034	Off Grindavik, Iceland
							9047	Off Siglufjord, Iceland

reenland

Recovery

epth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
115	63°22′	21°00′	$^{26}/_{3}$ 32	19$^{1}/_{2}$	740	♀	80—86	XIII?, 1919?	Fr.	**8622**
?	63°50′	22°00′	$^{2}/_{4}$ 31	7$^{2}/_{3}$	770	?	87—?		I.	**8656**
17	c. 60°42′	46°02′	$^{20}/_{9}$ 32	25	<10	♀	82—92		Gr.	8660
?	c. 64°22′	22°52′	$^{13}/_{3}$ 33	31	725	♀	63—79	IX, 1924	I.	**8663**
?	c. 60°37′	45°15′	Autumn 1931	c. 12	45 s	?	78—?		Gr.	8669
c. 113	c. 66°15′	23°20	$^{22}/_{4}$ 31	8$^{1}/_{3}$	760	♂	84—?		I.	**8675**
220	c. 64°58′	24°00′	$^{13}/_{4}$ 32	20	750	?	60—66		I.	**8693**
?	?	?	1932	?	?	?	65—?		I.	**8745**
c. 28	60°10′	45°20′	$^{22}/_{7}$ 32	23	35 s	?	60—68		Gr.	8746
c. 56	c. 60°46′	47°08′	$^{21}/_{5}$ 31	9	35 n	?	84—88		Gr.	8765
220	c. 66°29′	23°40′	$^{13}/_{5}$ 32	20$^{3}/_{4}$	755	♂	71—77	X?, 1922?	I.	**8777**
c. 94	c. 60°42′	46°02′	c. $^{23}/_{10}$ 30	c. 2	0	?	59—?		Gr.	8795
c. 50	c. 60°42′	46°01′	$^{16}/_{12}$ 32	28	<10	♀	65—76		Gr.	7606
180	c. 66°24′	23°11′	$^{1}/_{4}$ 33	31$^{1}/_{3}$	780	?	63—77		I.	**7617**
c. 225	66°58′	22°25′	$^{10}/_{2}$ 31	5$^{2}/_{3}$	820	?	84—?		E.	**7627**
?	c. 63°47′	22°20′	Spring? 33	?	740	?	86—?	XI, 1922[1])	I.	**7636**
?	c. 64°13′	23°11′	$^{26}/_{4}$ 32	20$^{1}/_{4}$	690	?	65—70		I.	**7638**
c. 263	c. 64°54′	24°04′	$^{18}/_{3}$ 34	43	690	♂	67—88	X?, 1924?	I.	**7644**
c. 105	c. 60°54′	46°04′	Dec.? 31	c. 15	35 n	?	77—?		Gr.	8812
c. 122	c. 64°17′	23°00′	$^{13}/_{5}$ 31	8$^{1}/_{2}$	740	♀	79—?	IX?, 1922?	I.	**8814**
c. 122	c. 63°40′	22°35′	$^{13}/_{5}$ 31	8$^{1}/_{2}$	750	?	82—84.5	IX, 1922	G.	**8817**
c. 132	c. 63°20′	21°30′	$^{10}/_{4}$ 31	7$^{1}/_{2}$	780	?	89—93.6		F.	**8838**
c. 173	c. 65°57′	21°04′	$^{21}/_{5}$ 33	33	840	♀	75—?		I.	**8844**
c. 188	66°37′	14°10′	$^{7}/_{8}$ 31	11$^{1}/_{3}$	980	?	78—79.8		F.	**8850**
?	c. 63°25′	20°45′	$^{27}/_{4}$ 31	8	810	♂	82—82.5	IX, 1922	I.	**8865**
12	c. 61°10′	48°27′	$^{14}/_{5}$ 32	20$^{2}/_{3}$	60 n	?	95—103		Gr.	8871
120	c. 64°25′	23°10′	$^{12}/_{4}$ 31	7$^{1}/_{2}$	740	♀	79—81		I.	**8875**
c. 41	c. 60°04′	45°10′	$^{25}/_{4}$ 31	8	74 s	?	70—?		Gr.	8879
?	c. 65°00′	23°50′	$^{28}/_{3}$ 33	31	750	♀	75—83	XI, 1922	I.	**8883**
?	c. 63°30′	21°50′	$^{23}/_{6}$ 31	10	760	♂	75—?		G.	**8885**
5	c. 60°33′	46°01′	$^{9}/_{6}$ 32	21$^{1}/_{2}$	35 s	?	74—78		Gr.	8888
c. 94	c. 64°23′	23°00′	$^{28}/_{4}$ 31	8	760	♀	82—83	IX, 1922	I.	**8889**
c. 207	c. 64°23′	12°28′	$^{15}/_{5}$ 33	32$^{1}/_{2}$	1020	?	62—75.8	IX?, 1924?[2])	G.	**8893**
c. 188	c. 67°00′	22°20′	$^{13}/_{5}$ 31	8$^{1}/_{2}$	820	♀	77—78	IX, 1922	I.	**8896**
300	c. 66°20′	18°50′	$^{29}/_{4}$ 31	8	935	♂	75—75	IX, 1922	I.	**8917**
?	c. 64°56′	24°10′	$^{8}/_{3}$ 34	42	820	♀	76—88	XII, 1922	I.	**8933**
?	c. 64°02′	22°50′	$^{1}/_{6}$ 31	9	805	?	68—?		E.	**8962**
?	c. 63°55′	16°11′	$^{15}/_{5}$ 32	20$^{1}/_{3}$	850	?	82—?	VI?, 1926?	E.	**8991**
c. 122	63°18′	20°34′	$^{31}/_{3}$ 33	30$^{3}/_{4}$	910	♀	63—73	VIII—XI?, 1925—1922?	I.	**9002**
130	c. 64°06′	23°10′	$^{28}/_{2}$ 34	42	840	♂	59—71		I.	**9004**
c. 28	c. 64°06′	52°00′	$^{17}/_{9}$ 31	12$^{1}/_{3}$	160 n	?	74—78		Gr.	9013
?	?	?	?	?	?	?	117—?		?	9023
?	c. 63°46′	22°30′	$^{17}/_{7}$ 31	10$^{1}/_{3}$	840	?	75—?		I.	**9034**
?	c. 66°25′	18°44′	$^{3}/_{4}$ 32	18$^{3}/_{4}$	935	♂	73—75	X, 1922	I.	**9047**

[1]) Vertebræ used for age determination. [2]) Vertebræ used.

Liberation

Exp. No.	Locality	Position Lat. N.	Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							9066	Off Skagatá, Iceland ...
							9078	Vigen, Frederikshaab District .....
							9084	Faxe Bay, Iceland ....
							9093	Off Malarif, Iceland ...
G 48 (f)	Kvanefjord, Frederikshaab District	61°58′	49°30′	$^{13\text{-}14}/_{9}$ 30	100	9101-9200	**9116**	Off Ritur, Iceland.....
							9180	Off Kagssimiut .....
G 49 (c)	Tasiusanguak, Frederikshaab	62°01′	49°35′	$^{27}/_{9}$ 30	50	9201-9250	**9224**	Patreksfjord, Iceland..
							9225	Arnarfjord, Iceland ....
							9248	Faxe Bay, Iceland....
G 28 (c)	Off Frederikshaab.....	62°00′	49°45′	$^{27}/_{9}$ 30	3	9251-9253		
G 50 (f)	Off Fiskenæsset.....	63°03′	50°48′	$^{6}/_{10}$ 30	97	9254-9350	**9259**	Off Gardskagi, Iceland.
							9298	Havnefjord, Iceland...
							9320	Off Lichtenfels.....
G 15 (f)	Kapisigdlit.....	64°23′	50°25′	$^{15}/_{10}$ 30	3	9351-9353	9353	Off Kapisigdlit .....
G 17 (f)	Kornok, Godthaab Fjord..	64°30′	50°58′	$^{17}/_{10}$ 30	11	9354-9364	9356	Kornok, Godthaab Fjord
							9359	Off Kapisigdlit .....
G 67 (f)	Umanak, Godthaab Fjord.	64°28′	50°45′	$^{18}/_{10}$30	86	9365-9450	**9365**	Off Selvogr, Iceland...
							9377	Off Holstensborg.....
							9395	Off Olafsvik, Iceland..
							9411	Little Hellefisk Bank..
							9418	Off Bolungarvik, Iceland
							9419	Hunaflói, Iceland .....
G 51 (c)	Kakaliak off Godthaab ...	64°05′	51°50′	$^{21\text{-}27}/_{10}$30	100	9451-9550	**9454**	Off Geirfuglasker, Iceland
							9504	Off Westmanna Isls., Iceland.....
							9505	Off Isafjord, Iceland...
							9532	Off Sandgerdi, Iceland.
							9549	Off Akranes, Iceland ..
G 5 (c)	Off Sukkertoppen.....	65°22′	52°52′	$^{1}/_{11}$ 30	4	9551-9554		
1931 (1652) **G 52** (b)	Little Hellefisk Bank	65°50.2′	54°26′	$^{26}/_{6}$ 31	69	10701-10769	10720	Great Hellefisk Bank..
							10722	Off Strømfjord.....
							10726	Off Holstensborg.....
							10732	S. of Great Hellefisk Bank
							10740	35 miles W. of Little Hellefisk Bank .....
							10756	Little Hellefisk Bank..
							10760	Great Hellefisk Bank..
							10761	Great Hellefisk Bank..
G 53 (b)	Great Hellefisk Bank.....	66°37.5′	54°58.3′	$^{3}/_{7}$ 31	52	10770-10821	**10777**	Off Westmanna Isls., Iceland.....
							10779	Little Hellefisk Bank ..
							10789	Off Hvalsbak, Iceland.
							10790	Off Little Hellefisk Bank
							10794	Off Great Hellefisk Bank

Greenland

Recovery

Depth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
c. 188	66°33′	20°21′	4/6 31	9	970	♀	86—86		I.	**9066**
5	c. 61°38′	49°00′	22/9 30	1/2	0	?	87—?		Gr.	9078
?	c. 64°45′	24°10′	1/5 31	7 2/3	810	?	82—?		F.	**9084**
80	64°41′	23°13′	24/5 32	20 1/2	735	♂	81—84.5		I.	**9093**
?	c. 64°22′	23°20′	14/5 31	8	840	?	70—?		I.	**9116**
c. 56	c. 60°48′	47°10′	23/10 34	49 1/3	100 s	♂	61—81.2	X, 1924	Gr.	9180
145	c. 65°45′	25°20′	20/5 31	7 3/4	805	?	73—?		Fr.	**9224**
c. 104	66°05′	24°45′	21/9 31	12	815	♀	81—?	IX?, 1922?	I.	**9225**
52	c. 64°22′	23°00′	19/4 31	6 2/3	840	♂	81—?	IX, 1922	I.	**9248**
?	c. 64°00′	23°30′	29/5 31	7 3/4	870	♂	80—81	IX, 1922	I.	**9259**
?	c. 64°05′	22°10′	6/7 31	9	925	?	83—83		I.	**9298**
c. 24	c. 63°04′	50°45′	11/5 31	7	<10	?	124—?		Gr.	9320
c. 19	c. 64°23′	50°25′	9/7 31	8 3/4	0	?	110—?		Gr.	9353
?	c. 64°30′	50°58′	3/5 34	42 1/2	0	♂	94—100	XII?, 1922?	Gr.	9356
c. 8	c. 64°20′	50°25′	24/4 34	42 1/4	<10	?	73—?		Gr.	9359
100	c. 63°39′	21°25′	7/4 33	29 2/3	1005	♂	87—93	XI, 1922	I.	**9365**
?	c. 66°55′	53°47′	July 1931	c. 9	225 n	?	111—?		Gr.	9377
c. 151	c. 65°00′	23°40′	28/4 31	6 1/3	980	♂	86—?		I.	**9395**
c. 75	c. 65°09′	53°27′	24/7 33	33	115 n	?	60—78.5		F.	9411
c. 85	c. 66°11′	23°10′	1933	>26	1070	♂	56—75	IX—XII?, 1924—1921?	I.	**9418**
?	c. 66°26′	20°10′	11/5 32	18 3/4	1110	♂	79 ?	X, 1922	I.	**9419**
c. 122	c. 63°43′	23°32′	14/4 31	5 3/4	935	♀	95—?		F.	**9454**
?	c. 63°20′	20°30′	c. 7/5 31	c. 6 1/2	1005	?	91—?		N.	**9504**
?	c. 66°14′	23°25′	28/2 32	16 1/4	755	?	88—92		I.	**9505**
?	c. 64°04′	23°02′	20/3 32	16 3/4	740	♀	86—89	X, 1922	I.	**9532**
?	c. 64°25′	23°10′	30/5 31	7	960	♂	91—92	IX, 1922	I.	**9549**
58	67°55′	55°02′	11/9 33	26 1/2	130 n	?	67.3—87		Fr.	10720
c. 85	c. 67°27′	54°00′	8/8 32	13 1/2	100 n	♀	92—?	X, 1922	F.	10722
?	c. 66°55′	53°48′	15/7 31	2/3	65 n	?	92—?		C.	10726
c. 66	66°25′	54°18′	7/8 34	37 1/3	35 n	♀	78.9—89.3	X, 1924	F.	10732
c. 256	64°30′	54°25′	24/4 32	10	80 s	?	111.5—?		E.	10740
?	66°14′	54°03′	2/8 33	25	30 n	?	80.9 85		F.	10756
?	67°02′	54°50′	25/8 32	14	75 n	?	88.5—95		P.	10760
?	c. 68°00′	53°50′	c. 15/8 31	1 1/2	130 n	?	102—?		C.	10761
?	c. 63°22′	21°00′	10/8 32	13	1360	?	90—?		Fr.	**10777**
?	65°50′	54°30′	1/7 32	12	50 s	?	92.9—?		Fr.	10779
c. 126	64°29′	12°34′	3/5 33	22	1530	?	86.8—?		E.	**10789**
?	66°26′	54°20′	4/7 32	12	20 s	?	86.7—?		Fr.	10790
?	66°25′	55°00′	Summer 32	?	<20	?	88—?		Fr.	10794

Liberation

Exp. No.	Locality	Position Lat. N.	Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
G 54 (b)	Little Hellefisk Bank	65°53.5′	53°48′	4/7 31	5	10822-10826		
G 8 (b)	Fylla Bank	64°10.5′	52°43′	5/7 31	15	10827-10841		
G 55 (b)	Great Hellefisk Bank.....	66°50.5′	54°14.5′	19/7 31	18	10842-10859	**10842**	Off Snæfellsnes, Iceland.
G 56 & 57 (b)	Great Hellefisk Bank	67°40.5′	54°24′	3/8 31	6	10860-10865		
G 58 (b)	Great Hellefisk Bank	67°37′	54°01′	4/8 31	7	10866-10872		
G 59 (b)	Fylla Bank.....	63°42.5′	52°23.5′	14/8 31	16	10873-10888		
G 60 (b)	Fylla Bank.....	64°04.5′	52°20.3′	15/8 31	55	10889-10943		
G 61 (b)	Dana Bank	62°18.5′	50°43.5′	17/8 31	1	10944		
G 62 (f)	Ikertokfjord.....	66°55′	52°30′	22-24/7 31	126	11701-11826	11711	Itivdlekfjord .....
							11717	Off Gardskagi, Iceland..
							11718	Off Kerrortussok.....
							11719	Amerdlokfjord.....
							11724	W. of Hunde Ejland ...
							11732	Off Kangamiut .....
							11749	Off Sarkardlit .....
							11785	Off Avatdlek .....
							11789	Great Hellefisk Bank...
							11802	Off Kerrortussok.....
							11804	Off Oriok .....
							11818	Amerdlokfjord.....
G 63 (c)	Ikerasak.....	67°58′	53°33′	29-30/7 31	21	11827-11847		
G 64 (c)	Aorfit	67°38′	53°40′	2/8 31	4	11848-11851	**11848**	Off Saudárkrókur, Icelan
G 65 (c)	Off Sukkertoppen.....	65°18′	53°05′	5-7/8 31	165	11852-12016	**11862**	Brede Bay, Iceland ....
							11866	Off Cape North, Iceland
							11874	Off Kangamiut .....
							11883	Off Napassok.....
							11889	Off Grindavik, Iceland..
							11890	Off Snæfellsjøkull, Icelan
							11904	Off Snæfellsnes, Iceland.
							11914	Off Sukkertoppen.....
							11949	Off Westmanna Isls., Ic land.....
							11988	Great Hellefisk Bank...
							11999	Iceland .....
G 65 (c)	Sukkertoppen	65°18′	52°55′	9/8 31	145	12017-12161	12018	Off Sukkertoppen.....
							12022	Narsak, Julianehaab Distr
							12087	Great Hellefisk Bank...
							12108	Off Napassok, Sukkertop
							12117	Off Sukkertoppen.....
							12122	Faxe Bay, Iceland .....
							12148	Off Little Hellefisk Bank
							12155	Off Sandgerdi, Iceland..
G 23 (f)	Ikamiuts Kangerdluarsuk..	65°37′	52°48′	13/8 31	48	12162-12209	12192	Off Agpamiut .....
							12198	Sermilinguakfjord.....
							12202	Off Ikamiut.....
G 66 (b)	Off Kangamiut	65°48′	53°40′	15/8 31	241	12210-12450	**12226**	Off Grindavik, Iceland..
							12240	Little Hellefisk Bank ...

reenland

Recovery

epth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
?	64°39′	23°48′	$^{3}/_{5}$ 33	$21^{1}/_{2}$	1150	?	101.2—?		I.	**10842**
c. 38	c. 66°30′	53°10′	$^{1}{}_{8}$ 31	$^{1}{}_{4}$	29 s	?	113—?		Gr.	11711
135	c. 64°25′	23°13′	$^{28}{}_{3}$ 33	$20^{1}{}_{4}$	1130	♀	87—96	XI, 1922	I.	**11717**
c. 8	c. 66°54′	53°30′	$^{9}{}_{7}$ 32	$11^{1}{}_{2}$	20 s	?	74—?		Gr.	11718
c. 47	c. 66°53′	52°52′	$^{28}{}_{5}$ 32	10	<20	?	114—115		Gr.	11719
c. 66	c. 68°50′	53°02′	$^{29}{}_{8}$ 31	$1^{1}{}_{4}$	150 n	♀	106—?		Gr.	11724
?	c. 65°58′	53°25′	$^{28}{}_{8}$ 33	25	85 s	?	110—?		Gr.	11732
c. 19	c. 66°52′	52°29′	$^{14}{}_{5}$ 32	$9^{2}/_{3}$	<10	?	85—?		Gr.	11749
c. 132	c. 66°48′	52°20′	$^{26}{}_{8}$ 31	1	<10	?	103—?		Gr.	11785
?	67°25′	54°15′	$^{5}{}_{8}$ 31	$^{1}/_{2}$	60 n	?	103—?		Fr.	11789
c. 9	c. 66°54′	53°30′	$^{9}/_{7}$ 32	$11^{1}/_{2}$	20 s	?	98 –?		Gr.	11802
c. 94	c. 66°49′	52°21′	$^{5}{}_{5}$ 32	$9^{1}/_{3}$	<10	?	65 –72		Gr.	11804
c. 9	c. 66°54′	53°02′	$^{23}/_{6}$ 32	11	<20	?	50 –58		Gr.	11818
c. 56	c. 65°46′	19°33′	$^{1}/_{6}$ 33	22	1410	?	95 –?		I.	**11848**
c. 94	c. 65°18′	23°25′	$^{12}{}_{5}$ 33	$21^{1}/_{4}$	1050	?	72– ?		N.	**11862**
?	66°45′	21°45′	$^{16}{}_{7}$ 32	$11^{1}/_{3}$	1160	?	93—97		F.	**11866**
?	c. 65°50′	53°25′	$^{12}{}_{8}$ 33	24	30 n	?	91—105		Gr.	11874
?	c. 65°02′	52°20′	1934	c. 36	20 s	?	64—?		F.	11883
?	63°49′	22°30′	$^{20}{}_{4}$ 33	$20^{1}/_{2}$	1070	♂	82– –?	XI, 1922	I.	**11889**
?	c. 64°32′	23°21′	$^{26}{}_{4}$ 32	9	1040	?	100—101		N.	**11890**
c. 102	64°40′	23°40′	$^{21}{}_{4}$ 33	$20^{1}/_{2}$	1060	?	74—83		I.	**11904**
?	c. 65°18′	52°53′	$^{6}/_{8}$ 31	0	<10	?	104—104		Gr.	11914
c. 169	63°26′	20°22′	$^{23}{}_{4}$ 33	$20^{2}/_{3}$	1100	♀	88—94	XI, 1922	I.	**11949**
?	67°53′	54°25′	$^{10}/_{9}$ 31	1	160 n	?	85—?		Fr.	11988
?	?	?	1933	c. 20	?	?	72—?		I.	**11999**
?	65°30′	53°30′	$^{21}/_{8}$ 31	$^{1}/_{3}$	<10	?	98—?		F.	12018
c. 66	c. 60°55′	46°05′	$^{21}{}_{5}$ 34	$15^{1}/_{2}$	340 s	♀	72—80	VIII, 1926	Gr.	12022
?	c. 67°20′	55°08′	$^{25}/_{9}$ 31	$1^{1}/_{2}$	136 n	?	94—?		Fr.	12087
c. 75	c. 65°02′	52°33′	$^{22}/_{5}$ 33	$21^{1}/_{2}$	20 s	?	106—?		Gr.	12108
c. 28	65°25′	53°29′	$^{15}/_{7}$ 34	35	10	♀	89—?		F.	12117
?	64°16′	22°16′	$^{29}{}_{4}$ 33	$20^{2}/_{3}$	1060	?	86—?		E.	**12122**
c. 256	64°30′	54°25′	$^{24}{}_{4}$ 32	$8^{1}/_{2}$	60 s	?	99—?		E.	12148
?	c. 64°02′	23°18′	$^{15}{}_{4}$ 33	$20^{1}{}_{1}$	960	♀	79—84	IX, 1924	I.	**12155**
c. 41	c. 65°40′	53°10′	$^{14}/_{7}$ 34	35	12	♀	74—85		Gr.	12192
c. 48	c. 65°36′	52°46′	$^{10}/_{9}$ 32	13	<10	?	99—?		Gr.	12198
c. 77	c. 65°35′	52°47′	c. $^{19}/_{10}$ 33	26	<10	?	81—85		Gr.	12202
c. 38	c. 63°49′	22°30′	$^{8}/_{4}$ 32	$7^{3}/_{4}$	1090	♀	85—87		I.	**12226**
?	66°20′	54°35′	$^{4}/_{7}$ 32	$10^{2}/_{3}$	45 n	?	66—?		Fr.	12240

Liberation

Exp. No.	Locality	Position Lat. N.	Long W.	Date and Year	No. marked	No. on labels
G 66 (b)	3 miles off Kangamiut	65°48′	53°35′	16/8 31	150	12451-12600
G 51 (c)	Kakaliak at Godthaab....	64°06′	51°50′	30/8 31	27	12601-12627
G 67 (f)	Umanak, Godthaab Fjord .	64°29′	50°47′	5-6/9 31	47	12628-12674
G 68 (c)	Off Godthaab.....	64°10′	51°45′	11/9 31	28	12675-12702
G 68 (c)	Off Godthaab.....	64°10′	51°50′	12/9 31	127	12703-12829
G 44 (f)	Tartok N. of Julianehaab .	60°50′	45°55′	2/10 31	66	12830-12895
G 31 (c)	Julianehaab.....	60°42′	46°10′	3/10 31	105	12896-13000

No. on label	Locality
12246	Off Málmey, Skagafjo Iceland .....
12248	Off Snæfellsjøkull, Icelar
12261	Little Hellefisk Bank..
12286	Off Narsarmiut at Kan miut .....
12322	Off Siglufjord, Iceland.
12330	Off Gardskagi, Iceland.
12339	Off Sukkertoppen.....
12355	Off South-West Iceland
12365	Ønundarfjord, Iceland.
12370	Off North Iceland.....
12374	Off Agpamiut, Hambo sund .....
12381	N. of Siglufjord, Icelan
12393	Off Snæfellsnes, Iceland
12421	Faxe Bay, Iceland ....
12442	Off Gardskagi, Iceland.
12444	Off Látrabjarg, Iceland
12449	Little Hellefisk Bank...
12456	Great Hellefisk Bank...
12473	Medalland Bay, Iceland
12575	Great Hellefisk Bank...
12629	Off Akranes, Iceland ..
12631	Kapisigdlit.....
12642	Kapisigdlit.....
12648	Great Hellefisk Bank..
12667	Off Siglufjord, Iceland.
12683	Off Akranes, Iceland ..
12698	Budahraun, Faxe Bay, I land.....
12706	Off Westmanna Isls., I land.....
12748	Off Kangek .....
12792	Off Ikerasarsuk, Fiskenæs
12841	Off Øndverdarnes, Icelan
12848	Off Akranes, Iceland ...
12865	Off Sletten.....
12879	Off Kakortok, Julianehaa Fjord.....
12934	Off Julianehaab.....
12935	Off Bjarnagnupr, Isafjo Deep, Iceland.....
12951	Off Thorlakshöfn, Icelan
12957	Off Portland, Iceland..
12959	Off Westmanna Isls., I land.....

reenland

Recovery

epth in etres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
. 113	c. 66°04′	19°34′	$^{14}/_{6}$ 32	10	1250	♀	81—88	X, 1922	I.	**12246**
c. 94	c. 64°43′	23°30′	$^{30}/_{4}$ 32	$8^{1}/_{2}$	1080	?	100—?		F.	**12248**
45	64°30′	53°30′	$^{25}/_{7}$ 34	$35^{1}/_{3}$	75 s	♂	68—76	VIII, 1926	F.	12261
?	c. 65°52′	53°30′	$^{18}/_{9}$ 33	25	0	?	65—?		Gr.	12286
c. 226	c. 66°23′	19°00′	$^{27}/_{5}$ 33	$21^{1}/_{2}$	1275	♀	91—98		I	**12322**
?	c. 64°08′	23°14′	$^{3}/_{5}$ 34	$32^{1}/_{2}$	1160	♀	65—82	X, 1924	I.	**12330**
c. 15	c. 65°23′	52°53′	$^{21}/_{7}$ 33	23	30 s	?	66—78	IX?, 1924?	Gr.	12339
?	63°20′	20°50′	c. $^{30}/_{4}$ 33	$20^{1}/_{2}$	1150	?	81—96.7	XI?, 1922?[1])	G.	**12355**
	or 63°48′	23°00′								
?	c. 66°05′	23°40′	$^{31}/_{5}$ 32	$9^{1}/_{2}$	1080	♀	65—?	VI, 1926	I.	**12365**
?	66°42′	21°04′	$^{20}/_{6}$ 34	34	1170	?	87—94		N.	**12370**
?	c. 65°33′	53°20′	$^{19}/_{8}$ 32	12	<20	?	81—86		Gr.	12374
100	c. 66°14′	18°58′	$^{4}/_{5}$ 32	$8^{2}/_{3}$	1270	?	85—87	X, 1922	I.	**12381**
?	64°38′	23°49′	$^{23}/_{4}$ 33	$20^{1}/_{4}$	1075	?	105—?		I.	**12393**
c. 35	c. 64°14′	22°17′	$^{11}/_{4}$ 33	20	1100	?	73—85.3	IX, 1924	E.	**12421**
?	c. 64°08′	23°19′	$^{28}/_{3}$ 33	$19^{1}/_{2}$	1060	♂	60—65		I.	**12442**
70	65°28′	24°45.5′	$^{7}/_{5}$ 34	$32^{2}/_{3}$	1070	♀	83—97	XII, 1922	F.	**12444**
c. 220	64°25′	54°10′	$^{4}/_{1}$ 32	$4^{2}/_{3}$	80 s	?	107—?		E.	12449
80	66°55′	54°50′	$^{20}/_{8}$ 34	36	75 n	♀	90—106		F.	12456
c. 113	c. 63°41′	17°30′	$^{3}/_{5}$ 32	$8^{1}/_{2}$	1200	?	84—89		F.	**12473**
50	67°28′	55°24′	$^{25}/_{9}$ 32	$13^{1}/_{3}$	102 n	?	68—72		Fr.	12575
?	c. 64°23′	22°52′	$^{19}/_{3}$ 32	$6^{1}/_{2}$	990	?	76—?	VIII—IX?, 1924—1923?	I.	**12629**
c. 47	c. 64°20′	50°25′	$^{28}/_{4}$ 32	$7^{3}/_{4}$	10	?	77—?		Gr.	12631
?	c. 64°25′	50°18′	$^{11}/_{5}$ 33	20	10	?	71—?		Gr.	12642
?	68°10′	55°00′	$^{11}/_{11}$ 31	$2^{1}/_{4}$	300 n	?	130—?		E.	12648
c. 188	c. 66°18′	19°01′	$^{19}/_{4}$ 33	$19^{1}/_{2}$	1180	♀	96—100	XI, 1922	I.	**12667**
100	c. 64°23′	23°00′	$^{26}/_{3}$ 33	$18^{1}/_{2}$	980	♀	81—?	XI, 1922	I.	**12683**
60	c. 64°35′	22°50′	$^{12}/_{5}$ 32	8	1020	♂	87—?	X?, 1922?	I.	**12698**
?	c. 63°17′	20°47′	$^{14}/_{4}$ 32	7	1040	?	100—?		N.	**12706**
c. 102	c. 64°06′	52°02′	$^{2}/_{8}$ 32	$10^{2}/_{3}$	<10	?	85—86		Gr.	12748
c. 40	c. 63°06′	50°40′	$^{29}/_{7}$ 32	$10^{1}/_{2}$	70 s	?	68—?		Gr.	12792
?	64°52′	24°04′	$^{10}/_{5}$ 33	19	740	♀	82—85		I.	**12841**
c. 32	c. 64°14′	22°20′	$^{18}/_{9}$ 32	$11^{1}/_{2}$	720	?	80—86		I.	**12848**
c. 34	c. 60°37′	45°22′	Summer 33	c. 20	35 s	?	71—76		Gr.	12865
c. 28	c. 60°48′	45°45′	$^{28}/_{10}$ 31	1	10	?	78—?		Gr.	12879
27	c. 60°42′	46°02′	$^{19}/_{7}$ 32	$9^{1}/_{2}$	0	?	86—89		Gr.	12934
?	c. 66°13′	23°02′	$^{6}/_{5}$ 32	7	785	?	87—?		I.	**12935**
?	c. 63°50′	21°20′	April 1933	18	770	?	90—?		I.	**12951**
c. 56	63°21′	19°27′	$^{1}/_{5}$ 33	19	830	?	66—?		G.	**12957**
?	63°15′	20°58′	$^{8}/_{4}$ 32	6	780	?	73—?		Fr.	**12959**

Vertebræ used.

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							12973	Off Arpatsivik
G 44 (f)	5 miles N. of Julianehaab	60°47′	45°57′	12/10 31	13	13051-13063		
G 69 (b)	Kagssit Isls., Holstensborg	66°58′	54°10′	9/7 31	62	9555-9616	9566	Great Hellefisk Bank
							9575	Off Kagssit Isls.
							9577	Off Kagssit Isls.
							9585	Off Holstensborg
							9616	Amerdlokfjord
G 70 (f)	Kekertalikfjord	66°47′	52°50′	19/7 31	33	9617-9649	9619	Kekertalikfjord
1932 G 71 (b)	Off Kangamiut	65°46′	53°28.5′	15/7 32	18	17651-17668	17665	Off Agpamiut
(1104) G 72 (b)	Great Hellefisk Bank	67°00.5′	54°14′	19/7 32	2	17669-17670		
G 73 (b)	Great Hellefisk Bank	67°37′	54°54′	4/8 32	2	17671-17672	17672	Great Hellefisk Bank
G 74 (b)	Great Hellefisk Bank	67°00′	55°04′	4-5/8 32	33	17673-17705	17675	Off Little Hellefisk Bank
G 75 (b)	Great Hellefisk Bank	67°26.5′	54°02′	9/8 32	18	17706-17723	17715	Great Hellefisk Bank
G 72 (b)	Kagssit Isls.	66°58′	54°10′	19/8 32	12	17724-17735	17726	Kagssit Isls.
							17732	Narsarmiut at Kangamiut
G 76 (b)	N. of Kangerdlugsuak	66°06′	53°42′	21/8 32	12	17736-17747		
G 77 (b)	Little Hellefisk Bank	65°20′	53°20′	14/8 32	19	18151-18169		
G 78 (b)	Little Hellefisk Bank	65°45′	54°00′	16/8 32	38	18170-18207		
G 80 (b)	Little Hellefisk Bank	65°30′	53°30′	15/8 32	4	18251-18254		
G 79 (b)	Little Hellefisk Bank	66°10′	54°15′	17/8 32	91	18208-18250, 18255-18302	**18212**	Off Gardskagi, Iceland
							18217	Off Olafsfjord, Iceland
							18260	Off Gardskagi, Iceland
							18290	Off Akranes, Iceland
G 81 (b)	Little Hellefisk Bank	66°00′	54°15′	18/8 32	98	18303-18400	**18341**	Off Faxe Bay, Iceland
							18378	S. of Great Hellefisk Bank
G 79 (b)	Little Hellefisk Bank	66°10′	54°10′	19/8 32	113	18401-18514	18472	Great Hellefisk Bank
							18480	Off Westmanna Isls., Iceland
							18485	Off Kangamiut
							18489	Off Malarif, Snæfellsnes, Iceland
							18512	Great Hellefisk Bank
G 79 (b)	Little Hellefisk Bank	c. 66°10′	54°20′	20/8 32	136	18515-18650	**18517**	Off Gardskagi, Iceland
							18535	Hafnarberg, Reykjanes, Iceland
							18567	Great Hellefisk Bank
							18579	Iceland
							18603	Westmanna Isls., Iceland
G 44 (f)	Kakortokfjord, Julianehaab District	60°48′	45°50′	26/5 32	49	7057-7100, 11446-11450	**7060**	Hvalsbak, Iceland
							7071	Off Siglufjord, Iceland
							7075	Westmanna Isls., Iceland
							7082	Off Gardskagi, Iceland
							7084	Off Kakortok

reenland

Recovery

epth in ietres.	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
c. 23	c. 60°45′	45°54′	$^{27}/_{7}$ 34	34	<10	♂	59—78	X?, 1924?	Gr.	12973
?	67°00′	54°10′	$^{3}/_{8}$ 32	13	<10	?	109—?		Nf.	9566
?	c. 66°58′	54°08′	$^{26}/_{7}$ 31	$^{1}/_{2}$	0	?	109—?		Gr.	9575
c. 89	c. 66°58′	54°08′	$^{10}/_{9}$ 31	2	0	?	116—?		Gr.	9577
100	66°31′	56°40′	$^{1}/_{8}$ 34	$36^{3}/_{4}$	65 s	?	91—93		Fr.	9585
c. 6	c. 66°52′	52°52′	1933—34?	?	20 s	?	95 102		Gr.	9616
c. 15	c. 66°47′	52°50′	$^{8}/_{6}$ 33	$22^{2}/_{3}$	0	?	50—63		Gr.	9619
c. 56	c. 65°39′	53°11′	$^{1}/_{6}$ 33	$10^{1}/_{2}$	12	?	68.5—?		Gr.	17665
?	67°56′	55°00′	$^{4}/_{9}$ 32	1	22 n	?	100.7—?		P.	17672
?	64°47′	54°12′	$^{13}/_{8}$ 32	$^{1}/_{4}$	135 s	?	96.7—?		P.	17675
?	c. 67°30′	55°00′	$^{8}/_{9}$ 32	1	22 n	?	102.6—?		Fr.	17715
c. 66	c. 66°58′	54°06′	$^{25}/_{8}$ 32	<1	<10	?	107.5—?		Gr.	17726
?	c. 65°52′	53°30′	$^{17}/_{10}$ 33	14	70 s	?	103.8—?		Gr.	17732
c. 151	64°05′	22°46′	$^{3}/_{5}$ 33	$8^{1}/_{2}$	1120	♀	94—97	>XI?, >1922?	I.	**18212**
c. 169	c. 66°07′	18°34′	$^{11}/_{6}$ 34	22	1300	♀	86—94	XII, 1922	I.	**18217**
?	c. 64°06′	23°21′	$^{5}/_{4}$ 33	$7^{2}/_{3}$	1060	♀	96—97	XI, 1922	I.	**18260**
85	c. 64°26′	23°02′	$^{5}/_{5}$ 34	$20^{1}/_{2}$	1460	♂	82—87	XII, 1922	I.	**18290**
160	64°25′	23°28′	$^{8}/_{2}$ 34	$17^{2}/_{3}$	1440	?	95—?		I.	**18341**
c. 132	66°27′	54°24′	$^{18}/_{8}$ 34	24	30 n	♀	83—?	X—XII?, 1922—1924?	F.	18378
?	67°25′	54°40′	$^{25}/_{8}$ 32	<1	77 n	?	83 ?		P.	18472
96	c. 63°22′	20°58′	$^{7}/_{4}$ 34	$19^{2}/_{3}$	1120	♀	84 88	X, 1924	I.	**18480**
c. 94	c. 65°50′	53°25′	$^{11}/_{10}$ 34	$25^{3}/_{4}$	30 s	♂	82 85		Gr.	18485
c. 113	c. 64°37′	23°50′	$^{14}/_{5}$ 34	$20^{3}/_{4}$	1080	♂	90 ?	XII, 1922	I.	**18489**
?	67°55′	54°54′	$^{22}/_{8}$ 33	12	105 n	?	90 ?		P.	18512
107	64°10′	23°47′	$^{2}/_{5}$ 33	$8^{1}/_{2}$	1040	♂	88 ?	XI, 1922	I.	**18517**
?	c. 63°52′	22°48′	$^{24}/_{4}$ 33	8	1080	?	90 ?	XI, 1922	I.	**18535**
?	67°15′	55°08′	$^{27}/_{8}$ 32	$^{1}/_{4}$	69 n	?	96 ?		P.	18567
?	?	?	$^{31}/_{3}$ 34	$19^{1}/_{3}$	?	?	93 ?	XII, 1922	I.	**18579**
?	c. 63°20′	21°00′	$^{6}/_{4}$ 34	$19^{1}/_{2}$	1120	?	89—95		E.	**18603**
?	64°36′	13°18′	$^{16}/_{6}$ 33	$12^{2}/_{3}$	1020	?	76 ?		E.	**7060**
200	c. 66°17′	18°46′	$^{18}/_{6}$ 34	$24^{2}/_{3}$	910	♂	67—75	X, 1924	I.	**7071**
c. 66	63°30′	20°34′	$^{31}/_{3}$ 33	10	780	♂	77—79	XI, 1922	I.	**7075**
?	c. 64°11′	23°20′	$^{17}/_{3}$ 34	$21^{2}/_{3}$	670	?	79 —?	X, 1924	I.	**7082**
9	c. 60°48′	45°50′	$^{4}/_{6}$ 32	$^{1}/_{3}$	0	?	84—?		Gr.	7084

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							7086	Off Kangamiut
							7094	Hafnarleir, Iceland
G 44 (f)	Tartok, Julianehaab Distr..	60°49′	45°55′	$^{17}/_{5}$ 32	24	11451-11474	11456	Off Siglufjord, Iceland
							11457	Selvogsbanki, Iceland
							11459	Niakornak
G 44 (f)	Kanisut	60°45.5′	45°44′	$^{28}/_{5}$ 32	7	11475-11481		
G 44 (f)	Kakortokfjord	60°48′	45°50′	$^{11.24}/_{6}$ 32	33	11482-11514	11492	Off Hofsnes, Iceland
							11509	Uperniviarssuk
							11511	Off Seydisfjord, Iceland.
G 18 (f)	Amituarssuk, Godth. Fjord	64°32′	50°35′	$^{18}/_{7}$ 32	41	11515-11555	11546	Sardlok, Godthaab Fjord
G 38y[1]) (f)	Sangmissok	60°00′	43°50′	$^{5}/_{9}$ 32	45	11556-11600		
					26	11651-11676		
G 44 (f)	Kakortokfjord	60°48′	45°50′	$^{26\text{-}27}/_{5}$ 32	50	11601-11650	11610	Arnarfjord, Iceland
							11620	Lónsvik, Iceland
							11632	Faxe Bay, Iceland
							11639	Jøkull Deep, Iceland
G 38x (c)	Itivdlek	59°53′	43°37′	$^{7}/_{9}$ 32	27	11677-11700, 13065-13067	11679	Off Akranes, Iceland
							11683	Snæfellsnes, Iceland
							11687	Snæfellsnes, Iceland
G 38y (f)	Sangmissok	60°00′	43°50′	$^{8}/_{9}$ 32	42	13068-13109	13084	Selvogsbanki, Iceland
							13103	Off Grindavik, Iceland
G 35 (c)	Nanortalik	60°10′	45°20′	$^{18,22}/_{9}$ 32	164	13110-13200, 14428-14500	13120	Off Cape North, Iceland
							13159	Siglufjord, Iceland
							13166	Off Reykjanes, Iceland
							13167	Off Patreksfjord, Iceland
							13173	Thistilfjord, Iceland
							13176	Brede Bay, Iceland
							13177	Off Skagatá, Iceland
							13181	Off Málmey, Skagafjor Iceland
							14449	Off Látrabjarg, Iceland
							14479	Nordfjord, Iceland
							14493	Off Malarif, Iceland
1933 G 47 (f) (625)	Off Neria, Frederikshaab District	c. 61°38′	49°00′	$^{24\text{-}27}/_{7}$ 33	125	13526-13650	13533	Off Akranes, Iceland
							13562	Sarfak at Fiskenæsset
							13566	Off Akranes, Iceland
							13578	Brede Bay, Iceland
							13615	Eldey, Iceland
							13643	Off Lóndrangar, Iceland
G 86 (c)	Avigait, Frederikshaab District	c. 62°15′	50°00′	$^{8}/_{8}$ 33	100	13651-13750	13657	Eldey, Iceland
							13709	N. of Hellisandur, Iceland
							13719	Off Akranes, Iceland
							13729	Iceland
							13730	Off Snæfellsnes, Iceland.
G 87 (c)	Grædefjord, Godth. District	c. 63°18′	51°10′	$^{16\text{-}18}/_{8}$ 33	100	13751-13850	13756	Off Grædefjord
							13760	Iceland

[1]) 38y and x — see p. 98, footnote.

reenland

Recovery

epth in netres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
?	66°10′	54°01′	$^{28}/_{7}$ 33	14	400 n	?	73—?		F.	7086
?	c. 63°56′	22°48′	$^{20}/_{4}$ 33	11	780	♀	74—?	IX?, 1924?	I.	7094
c. 282	66°26′	18°50′	$^{17}/_{5}$ 33	12	915	?	74—80		I.	11456
?	c. 63°25′	21°25′	$^{12}/_{4}$ 34	23	760	?	72—?		N.	11457
60	c. 61°00′	46°05′	$^{22}/_{9}$ 33	16	12	?	96—?		Gr.	11459
90	63°48′	22°04′	$^{27}/_{4}$ 33	$10^{1}/_{2}$	730	♀	115—?		F.	11492
?	c. 68°48′	45°50′	$^{17}/_{8}$ 34	$25^{1}/_{2}$	<10	♀	121—?	>XV, 1919÷	Gr.	11509
128	c. 65°19′	13°20′	$^{18}/_{5}$ 34	23	1010	♀	72—83	XII, 1922	I.	11511
c. 38	c. 60°32′	45°55′	$^{6}/_{3}$ 34	$19^{1}/_{2}$	25 s	?	80—84		Gr.	11546
?	c. 65°45′	23°48′	$^{12}/_{7}$ 34	$25^{1}/_{2}$	750	?	77—?		I.	11610
75	64°23′	14°20′	$^{24}/_{4}$ 34	23	990	♀	73—83	X, 1924	I.	11620
100	64°30′	23°10′	$^{26}/_{2}$ 34	21	730	♀	85—93	XII, 1922	I.	11632
?	c. 65°00′	23°50′	$^{16}/_{3}$ 33	$9^{2}/_{3}$	720	?	79—81		I.	11639
100	c. 64°23′	23°00′	$^{26}/_{3}$ 33	$6^{2}/_{3}$	670	♀	79—?	IX, 1924	I.	11679
84	c. 64°33′	24°23′	$^{10}/_{3}$ 34	18	720	?	73—80		E.	11683
200	c. 64°33′	24°23′	$^{31}/_{3}$ 33	$6^{3}/_{4}$	670	♂	87—88	XI—XII?, 1922—1921?	I.	11687
160	63°30′	22°00′	$^{9}/_{4}$ 34	19	640	♂	80—86	X, 1924	F.	13084
?	c. 63°50′	22°26′	$^{5}/_{4}$ 34	19	650	?	77—?		I.	13103
c. 101	66°40′	23°05′	$^{10}/_{6}$ 33	$8^{2}/_{3}$	780	?	80—?		E.	13120
?	c. 66°11′	18°51′	June 1933	c. 9	860	?	69—?		I.	13159
?	63°42′	23°45′	$^{10\text{-}15}/_{4}$ 33	c. 7	675	?	72—73.4		G.	13166
c. 104	65°47′	24°44′	$^{19}/_{5}$ 33	8	710	♂	66—66	IX, 1924	I.	13167
?	c. 66°15′	15°30′	$^{14}/_{9}$ 34	24	1010	?	64—78		I.	13173
?	c. 65°15′	23°50′	$^{10}/_{5}$ 33	$7^{3}/_{4}$	720	?	69—?		E.	13176
350	66°50′	19°40′	$^{11}/_{5}$ 33	$7^{3}/_{4}$	830	♂	73—73	IX, 1924	I.	13177
?	c. 66°05′	19°30′	$^{14}/_{6}$ 33	9	875	♂	80—?	XI, 1922	I.	13181
c. 88	c. 65°12′	24°40′	$^{8}/_{7}$ 34	$21^{1}/_{2}$	680	?	73—?		E.	14449
103	c. 65°03′	12°55′	$^{24}/_{7}$ 34	22	990	♀	71—?	X, 1924	I.	14479
?	64°45′	24°23′	$^{3}/_{3}$ 33	$5^{1}/_{3}$	720	♂	71—75		I.	14493
c. 87	c. 64°19′	22°56′	$^{5}/_{4}$ 34	$8^{1}/_{2}$	850	♀	81—84	X, 1924	I.	13533
c. 28	c. 63°05′	50°45′	$^{5}/_{7}$ 34	$11^{1}/_{3}$	100 n	♀	82—85	X?, 1924?	Gr.	13562
c. 94	c. 64°19′	23°00′	$^{22}/_{4}$ 34	9	850	♀	78—79	X, 1924	I.	13566
c. 92	65°10′	23°36′	$^{28}/_{5}$ 34	10	870	?	85—?		E.	13578
?	c. 63°43′	22°47′	March 1934	c. 8	825	?	90—90	X, 1924	G.	13615
c. 122	c. 64°37′	23°43′	$^{11}/_{5}$ 34	$9^{1}/_{2}$	835	♂	82—84		I.	13643
?	63°46′	23°10′	$^{12}/_{4}$ 34	8	860	?	88—91		G.	13657
160	c. 64°57′	23°56′	$^{7}/_{4}$ 34	8	860	♂	75—?		I.	13709
c. 85	c. 64°19′	22°56′	$^{6}/_{4}$ 34	8	890	♀	82—83	X, 1924	I.	13719
?	?	?	1934	?	?	?	94—?		I.	13729
?	c. 64°56′	24°08′	$^{11}/_{3}$ 34	7	860	♀	87—87	X, 1924	I.	13730
?	63°18′	51°19′	$^{18}/_{8}$ 33	<1	<10	?	106—106.6		F.	13756
?	?	?	$^{12}/_{4}$ 34	8	?	?	116—?		I.	13760

Wes

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
							13809	Off Akranes, Iceland....
							13812	Off Akranes, Iceland....
G 88 (c)	Napassok, Sukkertoppen District.....	c. 65°03′	52°20′	$^{8-9}/_{9}$ 33	73	13851-13923		
G 89 (f)	Kangiafjord, Sukkertoppen District.....	c. 65°15′	52°00′	$^{10}/_{9}$ 33	77	13924-14000	13942	Kangiafjord.....
							13993	Angmasivik at Atangmik
G 82 (b)	Fylla Bank	64°15′	52°45′	$^{12}/_{8}$ 33	25	14001-14025		
G 83 (b)	Between Fylla Bank and Little Hellefisk Bank...	64°25′	52°40′	$^{15}/_{8}$ 33	13	14026-14038	**14031**	Off Grimsey, Iceland ...
							14035	Off Reykjavik, Iceland..
G 84 (b)	Between Fylla Bank and Little Hellefisk Bank...	64°25′	52°30′	$^{16}/_{8}$ 33	4	14039-14042	**14040**	SE. of Reykjanes, Icelan
G 85 (b)	Fylla Bank	64°10′	52°40′	$^{22-23}/_{8}$ 33	108	14043-14150	**14118**	NW. of Eldey, Iceland..

Ea

Liberation

Exp. No.	Locality	Position Lat. N.	Position Long W.	Date and Year	No. marked	No. on labels	No. on label	Locality
1926 G 26 a (2)	Near Cape Dan.....	c. 65°37′	37°00′	$^{16-17}/_{9}$ **26**	2	1901-1902		
1927 G 26 b	Near Cape Dan.....	c. 65°37′	37°00′	$^{5}/_{9}$ **27**	6	1903-1908	**1903**	Off Reykjarfjord, Icelan
(100) G 26 c	Tasiussak	c. 65°36′	37°28′	$^{23}/_{9}$-$^{9}/_{10}$ 27	94	1909-2000, 2146-2149	**1931**	Off Stafnes, Iceland ....
1928 G 26 d (11)	Sarfakajik.....	c. 65°36′	37°23′	$^{9}/_{6}$, $^{16}/_{7}$ **28**	11	551-563		
1930 G 26 e (182)	Angmagssalik	c. 65°37′	37°30′	$^{21-28}/_{6}$ **30**	182	564-699, 1528-1532, 2151-2200	**567**	Midnessjór, Iceland....
							588	Kekertarssuatsiak.....
1931 G 26 f	Angmagssalik.....	c. 65°37′	37°33′	$^{2}/_{9}$ **31**	50	13201-13250		
(243) G 26 g	Angmagssalik.....	c. 65°37′	37°29′	$^{8-11}/_{9}$ 31	79	13251-13329	13299	Tasiusak, off Angmagssa
G 26 h	Angmagssalik.....	c. 65°37′	37°30′	$^{12}/_{9}$-$^{9}/_{10}$ 31	114	13330-13443		
1932 G 26 i (34)	Angmagssalikfjord	c. 65°42′	37°10′	$^{26}/_{6}$, $^{9-10}/_{7}$, $^{23}/_{7}$ **32**	34	13444-13477		
1933 G 26 k	Angmagssalik.....	c. 65°35′	37°30′	$^{12}/_{8}$ **33**	2	18951-18952		
(200) G 26 l	Kungmiut.....	c. 65°52′	36°55′	$^{4-11}/_{9}$ 33	159	18953-19111[1])	**18997**	Off Grindavik, Iceland..
							19011	Off Reykjanes, Iceland..
							19089	Off Vestra Horn, Icelan
G 26 m	Angmagssalik.....	c. 65°35′	37°30′	$^{14-18}/_{9}$ 33	39	19112-19150		

[1]) A few specimens taken with long-line.

Greenland

Recovery

Depth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
c. 94	c. 64°19′	23°00′	$^{22}/_{4}$ 34	8	970	♀	98—99	X, 1924	I.	**13809**
c. 94	c. 64°15′	22°55′	$^{31}/_{3}$ 34	$7^{1}/_{2}$	970	♀	97—98	XII?, 1922?	I.	**13812**
c. 15	c. 65°15′	52°00′	$^{15}/_{6}$ 34	9	0	?	56—60		Gr.	13942
?	c. 64°48′	52°10′	$^{16}/_{6}$ 34	9	35 s	?	57—?		Gr.	13993
c. 198	c. 66°32′	18°23′	$^{19}/_{6}$ 34	10	1200	?	83—?		E.	**14031**
?	c. 64°24′	22°20′	$^{5}/_{4}$ 34	$7^{2}/_{3}$	1020	♀	85—?	VIII, 1926	I.	**14035**
104	c. 63°40′	21°16′	$^{8}/_{4}$ 34	$7^{2}/_{3}$	1080	♂	83—?	X, 1924	I.	**14040**
170	c. 63°48′	23°43′	$^{23}/_{4}$ 34	8	960	♂	88—91	X, 1924	I.	**14118**

Greenland

Recovery

Depth in metres	Position (approximately) Lat. N.	Long W.	Date and Year	No. of months in the Sea	App. Distance of migration in miles	Sex	Initial and ultimate size in cm.	Age-group and year-class	Fishing vessel	No. on label
c. 119	c. 66°05′	21°10′	$^{18}/_{6}$ 31	$45^{1}/_{2}$	420	♂	66—86	IX, 1922	I.	**1903**
?	c. 63°55′	23°00′	$^{27}/_{3}$ 31	42	400	?	64.4—85		I.	**1931**
?	c. 64°11′	22°25′	$^{20}/_{4}$ 33	34	400	?	83—92	XI?, 1922?	I.	**567**
?	c. 65°48′	38°00′	November 1930	c. 4	30	?	70—?		Gr.	588
c. 45	c. 65°34′	37°25′	$^{11}/_{9}$ 31	$<^{1}/_{4}$	0	?	78—?		Gr.	13299
?	c. 63°50′	22°26′	$^{10}/_{4}$ 34	7	450	?	86—?	X, 1924	I.	**18997**
?	c. 63°50′	22°50′	c. $^{13}/_{4}$ 34	c. 7	410	?	72—74.7	XII?, 1922?	G.	**19011**
?	c. 64°00′	14°55′	$^{10}/_{4}$ 34	7	630	♀	76—?	X?, 1924?	I.	**19089**

Appendix B.

Index list to marking experiments 1924—33.

See chart Fig. 2, p. 7.

No. of experiments	Particulars to be found	
	App. A p.	Chart Fig. (p.)
1	94	**4**(16)
2	94	**4**(16)
3	94	**4**(16)
4	94	**4**(16)
5	94, 104	**4**(16), **18**(38)
6	94	**4**(16), **33**(68)
7	94	**7**(20)
8	94, 106	**7**(20), **21**(46)
9	94	**7**(20), **34**(69)
10	94	**7**(20), **34**(69)
11	96	**7**(20), **34**(69)
12	96	**7**(20)
13	96	**7**(20)
14	96	**9**(24)
15	96, 98, 104	**9**(24), **11**(26), **18**(38)
16	96	**9**(24)
17	96, 104	**9**(24), **18**(38)
18	96, 112	**9**(24), **24**(52)
19	96	**9**(24)
20	96	**9**(24)
21	96	**9**(24)
22	96	**9**(24)
23	96, 106	**9**(24), **21**(46)
24	96	**9**(24)
25	96	**9**(24)
26	114	**29**(61), **31**(62)
27	96	**11**(26)
28	96, 104	**11**(26), **18**(38), **33**(68), **34**(69)
29	98	**13**(30)
30	98	**13**(30)
31	98, 100, 102, 108	**15**(32), **18**(38), **21**(46)
32	98	**15**(32)
33	98	**15**(32), **34**(69)
34	98	**15**(32)
35	98, 100, 112	**15**(32), **18**(38), **24**(52)
36	98	**15**(32)
37	98	**15**(32)
38	98	**15**(32), **24**(52)
39	100	**18**(38)
40	100	**18**(38)
41	100	**18**(38)
42	100	**18**(38)
43	100	**18**(38)
44	100, 108, 110, 112	**18**(38), **21**(46), **24**(52), **34**(69)
45	102	**18**(38)
46	102	**18**(38)
47	102, 112	**18**(38), **27**(58), **34**(69)
48	104	**18**(38), **33**(68)
49	104	**18**(38)
50	96, 104	**9**(24), **18**(38)
51	104, 108	**18**(38), **21**(46)
52	104	**21**(46), **34**(69)
53	104	**21**(46)
54	106	**21**(46)
55	106	**21**(46)
56	106	**21**(46)
57	106	**21**(46)
58	106	**21**(46)
59	106	**21**(46)
60	106	**21**(46)
61	106	**21**(46)
62	106	**21**(46), **34**(69)
63	106	**21**(46)
64	106	**21**(46)
65	106	**21**(46), **33**(68), **34**(69)
66	106, 108	**21**(46), **34**(69)
67	104, 108	**18**(38), **21**(46), **34**(69)
68	108	**21**(46)
69	110	**21**(46)
70	110	**21**(46)
71	110	**24**(52)
72	110	**24**(52)
73	110	**24**(52)
74	110	**24**(52), **33**(68)
75	110	**24**(52)
76	110	**24**(52)
77	110	**24**(52)
78	110	**24**(52)
79	110	**24**(52), **34**(69)
80	110	**24**(52)
81	110	**24**(52)
82	114	**27**(58)
83	114	**27**(58)
84	114	**27**(58)
85	114	**27**(58)
86	112	**27**(58)
87	112	**27**(58)
88	114	**27**(58)
89	114	**27**(58)

Appendix C.

Explanation to the Charts:

-------- Migration to Iceland.

———— Migrations inside the West Greenland Area.

• Experiments with recaptures.

× Experiments without recaptures.

1, 2, 3 etc. No. of experiment, see Appendix A pp. 94—115, where particulars of each experiment are given (see Index list Appendix B p. 116).

1, 2, 3 etc. (italics) Number referring to lists facing the charts. In the lists 1) serial number of Cod migrating more than 20 nautical miles and 2) stationary or nearly stationary Cod (migrating < 20 nautical miles), marked with an asterisk.

The number at the arrow off Cape Farewell gives the total number of Cod emigrants to Iceland from all experiments of the respective year.

Signatures for Cod recaptured at Iceland.

○	recaught	1st	year	after	marking	year
•	—	2nd	—	—	—	—
+	—	3rd	—	—	—	—
▲	—	4th	—	—	—	—
△	—	5th	—	—	—	—
✲	—	6th	—	—	—	—
■	—	7th	—	—	—	—
□	—	8th	—	—	—	—

On the charts for Iceland will be found 1) number of marking experiment and 2) number of Cod. (For the years 1924—1928 furthermore the year of experiment, Fig. 5, p. 17).

Lists facing the charts give the following particulars:

1) Recaptures of respective experiments at Greenland.
2) — - — — - Iceland.
3) Number of marking experiment (heavy type).
4) Month of marking experiment.
5) Number of Cod marked and recaptured, e. g. 23/2.
6) Serial number of recaptured Cod; indexes *1, 2, 3* etc. referring to chart; * = specimens stationary or nearly stationary (migration < 20 nautical miles).

Dansk Resumé.

1. I Aarene 1924—33 er der ved Vest-Grønland særlig i Maanederne Juli—Oktober paa en stor Mængde forskellige Lokaliteter mærket 6811 Stkr. Torsk; ved Øst-Grønland er der i Aarene 1926—33 mærket 772 Stkr. De mærkede Torsk har næsten alle været mellem 50 og 115 cm lange.
2. Mærkede Torsk er endnu genfanget i det ottende Aar efter, at Mærkningen er blevet udført; dette viser, at den anvendte Fremgangsmaade ved Mærkningen er god.
3. I alt foreligger 397 Genfangster af de ved Vest-Grønland mærkede Torsk (eller 5,2 %), fra Øst-Grønlandsforsøgene 8 Genfangster (eller ca. 1 %). Af disse er 197 vandret fra Vest-Grønland til Island, og 6 fra Øst-Grønland til Island (se Tabellerne 43—45 og 74, samt de forskellige Kort i Afhandlingen).
4. De Torsk, der er genfanget ved Grønland, har for største Delens Vedkommende kun foretaget kortere Vandringer; dog er der en tydelig Tendens hos særlig store, gamle Torsk til at søge nordpaa (f. Eks. til Store Hellefiskebanke). Nogle af de Torsk, der ved Vest-Grønland er vandret sydpaa, synes at have paabegyndt Vandringen til Island.
5. Mellem Bankerne og Fjordene, ligesom omvendt, synes der ved Grønland kun at have været en ringe Udveksling af Torsk i Aarene 1924—34.
6. De til Island overvandrede Torsk er kønsmodne Individer, der har foretaget Vandringen for at gyde paa Gydepladserne ved Vest- og Syd-Island.
7. Meget faa Torsk over ca. 100 cm synes at foretage den lange Vandring til Island; Flertallet tilhører de stærkt vandrende Størrelser mellem 70 og 100 cm.
8. Udvandringen til Island har været størst fra de sydligste Kolonier ved Vest-Grønland (særlig stor for Torsk mærket i Julianehaab Distrikt).
9. Udvandringen til Island synes at være størst for Torsk mærket i Kystomraadet eller ude paa Bankerne ved Vest-Grønland, mindre for Torsk mærket inde i Fjordene.
10. Genfangstprocenten er høj i de første 3—4 Aar efter Mærkningen, hvorefter den falder stærkt (se Tabel 55, p. 75).
11. Overvandringen til Island finder Sted i Vintertiden (mellem Oktober og Marts). Mærkede Torsk tages derfor først ved Island i Aaret efter Mærkningens Udførelse.
12. Genfangsten ved Syd- og Vest-Island finder særlig Sted i Gydetiden, Marts—Maj.
13. Overvandringen til Island synes først at være begyndt rigtig i Vinteren 1929—30, men har været stærkt tiltagende i Aarene 1933—34. F. Eks. genfangedes i 1933 72 % af de dette Aar genfangede Torsk ved Island mod kun 28 % ved Grønland. Overvandringen har været af meget betydelige Dimensioner.
14. Samtidig med den stærke Udvandring fra Grønland til Island er Fiskeriets Udbytte ved Island tiltaget (f. Eks. pr. 100 Timers Trawling). Se Fig. 41, p. 88.

15. Der synes at være nogen Variation fra Aar til Aar i Procentmængden af Torsk, der vandrer til Island for at gyde.
16. De til Island overvandrede Torsk er særlig 9- til 11-aarige Fisk (nogle paa 6—8 Aar samt faa paa 12 Aar eller ældre vandrer dog ogsaa over).
17. Aldersanalyserne har endvidere vist, at de vandrende Torsk næsten udelukkende tilhører de i de senere Aar fremherskende store Aargange af Torsk født i 1922 og 1924.
18. Væksthastigheden af Torsk, der for første Gang nærmer sig Kønsmodenhed og vandrer til Island, synes at aftage.
19. Torsk mærket ved Øst-Grønland forholder sig med Hensyn til Udvandring til Island ligesom Torsk ved Vest-Grønland.
20. Det anbefales i Fremtiden at fortsætte Undersøgelserne ved kontinuerlige Mærkninger ved Grønland og Island samtidig med kontinuerlige hydrografiske og biologiske Undersøgelser af Havene i dette Omraade, da Kendskab til den omfattende Udveksling af Torsk mellem Grønland og Island samt Fluktuationer heri kan blive af afgørende Betydning for Fiskeriet ved Grønland.

Nr. 6 A. C. Strubberg: Marking Experiments with Plaice and Lemon Soles at the Færoes in 1910—12. 28 Fig. 1918. 64 p. Kr. 2.25.
» 7 Johs. Schmidt: Stations in the Atlantic, etc. 1911—15. With two Charts and introductory remarks. 1919. 27 p. Kr. 1.50.
» 8 A. C. Johansen: On the large spring-spawning Sea Herring (Clupea harengus L.) in the northwest European waters. 14 Fig. 1919. 56 p. Kr. 1.75.
» 9 A. C. Johansen and Kirstine Smith: Investigations as to the effect of the restriction on fishing during the war on the plaice of the eastern North Sea. 10 Fig. 1919. 53 p. Kr. 1.75.

Bind VI.

» 1 P. Jespersen: On the occurrence of the postlarval stages of the Herring and the »Lodde« (Clupea harengus L., and Mallotus villosus O. F. M.) at Iceland and the Færoes. 1920. 10 Fig. 24 p. Kr. 1.25.
» 2 Kirstine Smith: Danish Investigations of Plaice from the North Sea July 1919—July 1920. 1921. 2 Fig. 68 p. Kr. 4.75.
» 3 A. C. Johansen: On the Summer-spawning Herring (Clupea harengus L.) of Iceland. 1921. 4 Fig. 40 p.
» 4 A. C. Johansen: The Atlanto-Scandian Spring Herring spawning at the Faroes 1921. 11 p. Kr. 3.75.
» 5 J. P. Jacobsen and A. C. Johansen: On the Causes of the Fluctuations in the Yield of some of our Fisheries. I. The Salmon and Sea Trout Fisheries. 1921. 11 Fig. 18 Tab. 48 p. Kr. 3.50.
» 6 Johs. Schmidt: Contributions to the Knowledge of the Young of the Sun-Fishes (*Mola* and *Ranzania*). 1921. 1 Pl. 15 Fig. 13 p. Kr. 1.50.
» 7 Erik M. Poulsen: On the Frequency and Distribution of *Crangon vulgaris, Carcinus mænas* and *Portunus holsatus* in the Danish coastal waters. 1922. 4 Fig. 2 Tab. 18 p. Kr 1.65.
» 8 A. C. Johansen: On the Density of the Young Plaice Population in the eastern part of the North Sea and the Skagerak in pre war and in post war years. 1922. 10 Fig. 10 Tab. 31 p. Kr. 2.50.
» 9 J. P. Jacobsen and A. C. Johansen: On the Causes of the Fluctuations in the Yield of some of our Fisheries. II. The Eel Fisheries. 1922. 20 Fig. 6 Tab. 32 p. Kr. 2.75.

Bind VII.

» 1 A. C. Strubberg: Marking Experiments with Cod (Gadus callarias L.) in Danish Waters, 1905—1913. 1922. 17 Fig. 27 Tab. 60 p. Kr. 4.25.
Nr. 2 Kirstine Smith: Investigations of Plaice from the Western Baltic June 1921—August 1922. 1923. 6 Fig. 14 Tab. 48 p. Kr, 3.50.
» 3 Bjarni Sæmundsson: On the Age and Growth of the Cod (Gadus callarius L.) in Icelandic Waters. 1923. 8 Fig. 35 p. Kr. 2.75.
» 4 Kirstine Smith: On the Plaice Population of the Horns Reef Area in the Autumn of 1922. 1923. 14 Fig. 78 p. Kr. 5.50.
» 5 A. C. Johansen: On the Summer- and Autumn-Spawning Herrings of the North Sea. 1924. 15 Fig. 119 p. Kr. 8.00.
» 6 P. L. Kramp: Fish eggs and larvæ collected in the Belt Sea in March 1922. 1924. Kr. 1.75.
» 7 Ad. S. Jensen: On the Fishery of the Greenlanders. 1925. 31 Fig. 1 Chart. 38 p. Kr. 3.00.
» 8 A. C. Johansen: On the Influence of the Currents upon the Frequency of the Mackerel in the Kattegat and adjacent parts of the Skagerak. 1925. 15 Fig. 26 p. Kr. 2.25.

Bind VIII.

» 1 Bjarni Sæmundsson: On the age and growth of the Haddock (Gadus æglefinus L.) and the Whiting (Gadus merlangus L.) in Icelandic waters. 1925. 8 Fig. 33 p. Kr. 2.65.
» 2 A. C. Johansen: On the diurnal vertical Movements of Young of some Fishes in Danish Waters. 1925. 11 Fig. 28 p. Kr. 2.25.
» 3 Martin Knudsen: A Bottom Sampler for hard Bottom. 1927. 2 Fig. 4 p.
» 4 A. C. Johansen: Preliminary Experiments with Knudsen's Bottom Sampler for hard Bottom. 1927. 3 Tab. 6 p. Kr. 1 25.
» 5 Anton Fr. Bruun: Quantitative investigations of the 0-group and I-group of the Plaice, Turbot, Brill and Sole in the Skagerak, Kattegat and Belt Sea. 1927. 6 Fig. 30 p. Kr. 2.50.
» 6 Aage J. C. Jensen: An Investigation of the Stock of Plaice in the Southern Horns Reef Area in the Years 1925 and 1927. 1928. 13 Fig. 44 Tab. 63 p. Kr. 4.50.
» 7 Bjarni Sæmundsson: On the Age and Growth of the Coalfish (Gadus virens L.), the Norway Pout (Gadus Esmarki Nilsson) and the Poutassou (Gadus poutassou Risso) in Icelandic waters. 1929. 7 Fig. 37 p. Kr. 3.65.
» 8 Aage J. C. Jensen: On the Influence of the Size of the Stock of Cod upon the yield of the Herring Fishery in the Kattegat, Belt Sea, and Western part of the Baltic, and some other causes of variations in the Cod and Herring Fisheries. 1929. 3 Fig. 2 Tab. 16 p. Kr. 1.50.

The name »Kommissionen for Havundersøgelser« has from the 1st of September 1926 been changed to: »Kommissionen for Danmarks Fiskeri- og Havundersøgelser«.

MEDDELELSER FRA
KOMMISSIONEN FOR DANMARKS FISKERI- OG HAVUNDERSØGELSER

Bind IX.

Nr. 1 Erik M. Poulsen: Biological Investigations upon the Cod in Danish Waters. 1931. 43 Fig. 29 Tab. 148 p. Kr. 10.00.
» 2 Aage J. C. Jensen: Investigations of the Plaice Stock in the southern Horns Reef Area in the years 1928—30. 1931. 7 Fig. 16 + 15 Tab. 32 p. Kr. 2.50.
» 3 Å. Vedel Tåning: Fluctuations in the Stock of Cod in Icelandic Waters. 1931. 13 Fig. 34 + 4 Tab. 43 p. Kr. 3.15.
» 4 Erik M. Poulsen: On the spawning places of the herring in certain parts of the North Sea, the Skagerak, and the Kattegat in the autumn of 1930 and some earlier years. 1932. 10 Fig. 2 Tab. 17 p. Kr. 1.65.
Nr. 5 Aage J. C. Jensen: Periodic Fluctuations in the Size of Various Stocks of Fish and their Causes. 1933. 21 Fig. 28 Tab. 70 p. Kr. 5.00.
» 6 Anton Fr. Bruun and Børge Heiberg: The "Red Disease" of the Eel in Danish Waters. 1932. 1 Fig. 1 Tab. 20 p. Kr. 1.65.
» 7 A. C. Strubberg: Marking Experiments with Cod at the Faroes. II. Second Report. Experiments in 1923—1927. 1933. 13 Fig. 18 Tab. 36 p. Kr. 3.00.

Serie: Plankton
„ : Hydrografi } see cover of these publications.

SKRIFTER UDGIVNE AF KOMMISSIONEN

Nr. 1 JOHS. SCHMIDT: Fiskeriundersøgelser ved Island og Færøerne i Sommeren 1903. 10 Tavler. 1904. VI + 148 S. Kr. 5.00. Udsolgt.

» 2 MARTIN KNUDSEN: Havets Naturlære. Hydrografi. Med særligt Hensyn til de danske Farvande. 10 Figurer, 4 Tavler. 1905. 41 S. Kr. 1.75. Udsolgt.

» 3 JOHAN HJORT og C. G. JOH. PETERSEN: Kort Oversigt over de internationale Fiskeriundersøgelsers Resultater med særligt Henblik paa norske og danske Forhold. 10 Tavler. 1905. 54 S. Kr. 3.50.

» 4 MARTIN KNUDSEN, C. G. JOH. PETERSEN, C. F. DRECHSEL, C. H. OSTENFELD: De internationale Havundersøgelser 1902—07. 1908. 28 S. Kr. 0.75.

» 5 BJARNI SÆMUNDSSON: Oversigt over Islands Fiske med Oplysning om deres Forekomst, vigtigste biologiske Forhold og økonomiske Betydning. 1 Kort. 1909. 140 S. Kr. 2.25.

Nr. 6 ANDREAS OTTERSTRØM: Sildens Afhængighed af forskellige hydrografiske og meteorologiske Forhold i Store Bælt. 2 Textfigurer. 1910. 52 S. Kr. 1.00.

» 7 A. C. JOHANSEN: Om Rødspætten og Rødspættefiskeriet i Beltfarvandet med nogle Bemærkninger om de øvrige Flynderarter og Flynderfiskerier i samme Farvand. 23 Tavler, 14 Textfigurer. 1912. 158 Sider. Kr. 3.00.

» 8 JOHS. SCHMIDT: Danske Undersøgelser i Atlanterhavet og Middelhavet over Ferskvandsaalens Biologi. 3 Tavler, 5 Textfigurer. 1912. 33 Sider. Kr. 1.50.

» 9 A. C. JOHANSEN og J. CHR. LØFTING: Om Fiskebestanden og Fiskeriet i Gudenaaens nedre Løb og Randers Fjord. — With an English Resumé. 4 Tavler. 42 Textfigurer. 1919. 169 Sider. Kr. 3.75.

» 10 ERIK M. POULSEN: Om Hummeren og Hummerfiskeriet i de danske Farvande. 6 Textfigurer. 1927. 42 Sider. Kr. 1.00.

Notice:

It is requested that notice of any error in address or other communications concerning mailing etc. of this publication is sent to: Marinbiologisk Laboratorium, Vestre Boulevard 42, Copenhagen.

A complete list of the subjects included in the finished volumes will be furnished on application.